

MEDICAL JURISPRUDENCE

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INTRODUCTION

TO

MEDICAL JURISPRUDENCE

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LONDON


BAILLIÈRE, TINDALL AND COX

8, HENRIETTA STREET, STRAND

[PARIS AND MADRID]

1901

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P R E F A C E

IN this book an attempt has been made to state the essentials of Medical Jurisprudence as definitely and, at the same time, as briefly as possible, without producing a 'cram' book.

The points of law most likely to arise are set forth without comment, since in this form the reader can find out what the law is—concerning insanity, for example—more satisfactorily than when it is stated together with confusing opinions with regard to what it ought to be.

Only the poisons that are most frequently fatal are described. It is hoped that the alphabetical arrangement of them, and the table of doses of the remedies usually employed in their treatment, will be found convenient.

W. M.

May 1, 1901.

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ERRATA

Page 2, line 19, *for* 'essential parts of the law,' *read* 'essential part of the law.'

Page 4, line 12, *for* 'a fine of £5,' *read* 'a fine of £2.'

MEDICAL JURISPRUDENCE

INTRODUCTION

MEDICAL JURISPRUDENCE may be briefly described as the legal aspect of a medical practitioner's work. It includes every branch of the science of medicine of use in the law courts and in the legal relations with which a practitioner is brought into contact, as well as those parts of the laws of his country with which he should be familiar.

In his practice he has not only to diagnose and treat his cases, but also to consider them with regard to their legal aspect or the liability to legal proceedings arising from them.

Although it has been stated that 'when a diploma to practise medicine is taken, there is practically received with it a commission for the detection of crime,' it is generally considered that such a commission is neither accepted nor implied, and that a medical practitioner should avoid assuming the position of detective among his patients. He can, of course, exercise a check on certain crimes by force of his reputation as a medical jurist, or, by means of his investigations and opinions, assist in preventing the conviction of the innocent as well as in bringing the guilty to justice.

That medical jurisprudence deserves as careful study as

therapeutics, gynæcology, or any other part of medical knowledge, should go without saying. Nevertheless, there is an idea among students, and even among practitioners, that the needful information can be had when required, *e.g.*, on the eve of stepping into the witness-box, where, it is hardly necessary to remark, a medical witness should be armed with mature knowledge and definite opinions, since he has not the opportunities of avoiding error that are afforded in the consulting-room or at the bedside, by suspending his opinion for further consideration or inquiry.

In addition to appearing as a witness, a medical practitioner performs many medico-legal duties not immediately connected with proceedings in law courts, such as certifying in cases of insanity, examining for life insurance, and giving opinions, or making reports on many other medico-legal questions.

In order that he may understand the legal nature of the cases in which he is most liable to be called upon to act or give evidence, the essential parts of the law with regard to them is given as fully as the size of this book permits.

LAW COURTS

THE courts in England in which a medical witness is most likely to appear are, in criminal cases, the Coroner's Court, the Magistrates' Court, Quarter Sessions, and the Assizes; in civil cases, the County Court, the Assizes, and the High Court.

The **Coroner's Court** is held to determine, with the aid of a jury, by evidence, the cause of sudden death within the district.

The coroner cannot hold an inquest unless there is the dead body of a person lying within the area of his jurisdiction. A stillborn child cannot form the subject of an inquest, but it may be necessary to decide whether a child was stillborn or not. Some coroners hold inquests on almost any recognisable portion of a human body found under suspicious circumstances, but this appears to be at variance with some early decisions.

The coroner does not appear to have an absolute right to hold an inquest in every case in which he chooses to do so. He must have a reasonable cause of suspicion *e.g.*, that there was something peculiar about the death, or that there was more than common illness. Where two or more infants, under the age of five years, are kept for reward, for the purpose of nursing or maintaining them, if one of them dies, he must hold an inquest unless he is

satisfied with the certificate of the medical attendant of the cause of death.

The coroner can summon as a witness the practitioner who attended the deceased, and can order him to make a post-mortem examination for the purpose of testifying at the inquest as to how the deceased came to his death. If the deceased has not been attended, the coroner can summon any medical man in actual practice in the neighbourhood. If a witness refuses to obey the summons, the coroner can issue a warrant against him, and cause him to be apprehended and brought to the court, and may commit him for contempt or inflict a fine of £5 if he refuses to give evidence.

As the result of the inquest, the coroner can commit for trial for murder or manslaughter; but this rarely occurs, the accused being almost always brought before the magistrates.

At the **Magistrates' Court** an accused person may be liberated or committed for trial to the Quarter Sessions or the Assizes. But the magistrates may try all children under twelve years of age for any offence other than homicide, if the parents or guardians do not object, and, for certain offences, persons over twelve years if they consent.

At **Quarter Sessions** the lighter kinds of offences may be tried. These include common and indecent assaults, and wounding or inflicting grievous bodily harm.

At the **Assizes** must be tried, among other crimes, murder, attempt to murder, manslaughter, rape, offences against the Criminal Law Amendment Act, 1885 (defilement of girls under sixteen years), concealment of birth, and the aggravated assaults of administering poisons, and

of wounding or causing grievous bodily harm, *with intent* to maim, disfigure, or do grievous bodily harm.

Before a prisoner, committed for trial, can be brought into open court, at Quarter Sessions or Assizes, and required to plead, a 'Bill,' that is, a written accusation against him, is laid before the grand jury, who hear the testimony of some of the witnesses for the prosecution. If they think the case should go no further, they 'throw out the bill,' but, on the other hand, if they consider there is a *prima-facie* case against the prisoner they 'find a true bill,' and he is consequently tried.

In Ireland the procedure and courts are much the same as in England.

In Scotland the Procurator Fiscal initiates criminal proceedings on information supplied by the police or by private persons. An examination of witnesses is held before the Sheriff or Justice, and the accused is either liberated, or committed and tried before the Sheriff, or one of the Circuit Courts of Justiciary, or the High Court. The office of coroner does not exist in Scotland. His duties with regard to a dead body are performed by the Procurator Fiscal, who acts without a jury and can order a post-mortem examination.

CRIMES

In English law crimes are arranged under three headings: treasons, felonies, and misdemeanours. Of these, only felonies and misdemeanours are likely to concern a medical practitioner. Although the distinctions between them were formerly of importance, they are now, to a great extent, arbitrary, and need not be discussed.

A person implicated in the commission of a felony is either a *principal* or an *accessory*. He is a principal *in the first degree* if he actually commits the crime, which he can do either by his own hands or through the medium of an innocent agent; or *in the second degree* if he aids and abets the commission of a crime, as by keeping watch outside while another commits a felony inside a house. He is an accessory *before the fact* if the crime is committed in his absence by another whom he has procured or commanded to do it, *e.g.*, if he hires an assassin; or *after the fact* if he helps or harbours a person whom he knows has committed a felony.

Principals and accessories before the fact are separately and independently guilty, and can be indicted, tried, and punished accordingly; but an accessory after the fact, although he can be tried for a substantive felony, independently of the principal, is not so severely punished. In misdemeanours all are principals. A person is guilty of the misdemeanour of misprision of felony if he knows that another has committed a felony and conceals it.

At law, a child under the age of seven years is conclusively presumed incapable of crime, and ought not to be tried, or even arrested. Between the ages of seven and fourteen the presumption is that he cannot commit a crime; but this can be rebutted by proof of a mischievous discretion.

MEDICAL EVIDENCE

If a medical man is legally summoned as a witness to any court of law, criminal or civil, and does not appear, he is liable to a fine or other punishment, and, in civil cases, to damages due to his absence, unless his appearance is prevented by some sufficiently good reason.

It seems to be the correct opinion that he is not bound to appear as an expert witness with regard to a person he has never attended. Nevertheless, his safest procedure is to appear when legally summoned and state the grounds on which he declines to give evidence.

A witness in a coroner's court or before the magistrates should be as careful as if he were in one of the higher courts. Statements and opinions should be as clear and as definite as possible, as they are taken down in writing, and copies of them are in the hands of the judge and counsel at subsequent trial of the same case at Quarter Sessions or Assizes.

A medical man, to be successful as a witness, must avoid being a partisan. His duty in the witness-box is simple. As a **common witness** he has to state, in plain language, the facts within his own knowledge; or, as an **expert witness**, to express his opinions according to the state of knowledge with regard to their subject-matter, and not, on any account, according to the effect they may have for or against the prosecutor, the prisoner, the plaintiff, the defendant, or any other party. If this rule were adhered to, many medical witnesses would avoid the disagreeable and often damaging situations in which they frequently find themselves after cross-examination, and expert testimony would be less conflicting, and regarded with more favour than at present.

As a rule, a witness is not permitted to state his belief or opinion. It is for him to state facts, and for the court or jury to form opinions on them. But if inexperienced persons are likely to prove incapable of forming a correct judgment without assistance, then the opinion of witnesses possessing special skill or knowledge on the subject-matter of inquiry is permissible. For this reason medical men

are frequently called upon to state opinions as expert witnesses.

A witness can refer to notes to refresh his memory if they have been taken at the time or immediately after the events to which they relate.

A medical witness cannot refuse to answer questions on the ground of professional secrecy.

Dying declarations form an exception to the rule that hearsay evidence must be rejected. But they are admitted in evidence only in case of homicide, when the death of the declarant is the subject of the charge, and they have been made in full apprehension and actual danger of death, which ensues. They are occasionally made by a patient to his medical attendant, and, as it is necessary to give them in the words of the deceased, they ought to be written down at the time they are spoken.

The **fees** payable to a medical witness at the coroner's court are one guinea for giving evidence, and another for making a post-mortem examination if this has been ordered by the coroner. In England, no fees are allowed a medical officer who has attended the subject of an inquest in a county or other lunatic asylum, or in a public hospital, infirmary, or other medical institution, whether the same be supported by endowments or by voluntary subscriptions. The medical institutions here referred to are not clearly defined. They have been held by a county-court judge to include even the sick wards of a workhouse.

At the magistrates' court the fee is usually half a guinea if the court is within three miles from the witness's surgery or residence, but a guinea if beyond this distance. At superior courts the fee is one, two or more guineas a day, and travelling expenses.

REPORTS

In making medical reports, accuracy in statement of facts and clearness in expression of opinions are to be aimed at, and unnecessary comment avoided.

If a report is for the guidance or instruction of laymen, it is well to abstain from technical language where it is not absolutely necessary.

STATUS OF PRACTITIONER

As it is necessary to be registered under the Medical Acts, 1858-86, in order to be able to do any of those things directed by law to be done by a medical practitioner, a short description of the legal status of a registered medical practitioner is essential.

The medical profession in the British Isles is ruled by the **General Medical Council**, subject to the supervision of His Majesty in his Privy Council, according to the Medical Acts, 1858-86, by which the Medical Council has been established and its duties defined. It consists of thirty members, of whom five are appointed by the Crown, one by each of the qualifying bodies in the United Kingdom, and five are elected by those who are on the Medical Register—three for England, one for Scotland, and one for Ireland. Its chief duties are, to keep the Medical Register, to maintain an efficient standard of medical education, and to publish the Pharmacopœia.

The Medical Council requires that a medical student be registered five years as a student before he can be put on the

Medical Register. To be registered as a student, he must pass an educational examination, and produce evidence that he has commenced medical study at a University or other place recognised by the Council.

To be put on the **Medical Register**, an applicant must have obtained qualifications in medicine, surgery, and midwifery at one or more of the qualifying bodies represented on the Council, after a curriculum and examinations approved of by the Council. Women can be registered, but all the qualifying bodies do not grant them the necessary degrees or diplomas.

If a qualifying body attempts to make it obligatory on any candidate to adopt or refrain from adopting the practice of any particular theory of medicine or surgery, the Privy Council, on representation made by the Medical Council, may issue an injunction directing them to desist from such practice, and, if they fail to comply, can remove their power of conferring any right to be registered as long as they continue the practice.

Practitioners of the colonies and, with certain restrictions, of foreign States, defined by His Majesty in Council, can be put on the Register, if reciprocal facilities are granted to practitioners of the United Kingdom, and if the applicants hold recognised colonial or foreign diplomas, as the case may be, and are of good character. A recognised diploma must be one which the Medical Council considers a sufficient guarantee for the requisite knowledge and skill for the efficient practice of medicine, surgery, and midwifery.

Any person who becomes, or attempts to become, registered by a false representation or declaration, or aids another in doing so, is liable to twelve months' imprisonment.

Only those who are registered can obtain medical appointments in the army, navy, under the Local Government Board, in lunatic asylums, gaols, emigrant or other vessels, public bodies and friendly societies; or sue for expenses, medicines, appliances, and fees for professional attendance; or sign certificates; or, as already stated, do any of those things directed by law to be done by a medical practitioner. They can practise in any part of the United Kingdom, and, subject to local laws, in any part of His Majesty's dominions. They are exempted, if they so desire, from serving on juries, or in the militia, or in any municipal or parochial office.

Under the Apothecaries' Act, 1815, which applies to England only, an unregistered person is liable to a fine of £20 if he attends another requiring *medical* care, and prescribes and supplies medicines to him. Beyond this the law does not prohibit any person not on the Medical Register treating another medicinally or surgically, or acting as a midwife.

A qualified but non-registered medical man can practise according to his qualifications, but he cannot sue for fees, nor can he exercise any of the functions of a registered medical practitioner, which include signing death certificates.

Any person who wilfully or falsely assumes medical titles or otherwise holds himself out to be registered or recognised by law as a physician or surgeon or apothecary is liable on conviction before the magistrates to a penalty of £20.

The Medical Council has power to remove from the Register the name of any registered practitioner who has been convicted in England or Ireland of any felony or misdemeanour, or in Scotland of any crime or offence; or whom

it judges, after due inquiry, guilty of infamous conduct in any professional respect, before or after registration; or who has been lawfully struck off the list by the University or College at which he was qualified. But it cannot remove the name of anyone because he has adopted any particular theory in medicine or surgery.

There is no appeal from the decision of the Medical Council on questions of conduct or of fact connected therewith.

LIFE AND SURVIVORSHIP

A person is alive to his legal rights and liabilities from the time of complete birth until somatic death.

When a person has been proved to be alive and in health at any time, there is a presumption that he continued to live for some indefinite time after, but there is no rule to determine when this presumption of life ceases.

If two or more persons die from the same cause, for example, if they are swept off a ship at the same time by a wave, there are no rules of law to decide who was the survivor by reason of age, sex, or other circumstances. The presumption is that they all died at the same moment, and any person claiming a benefit on the ground that one survived another must rebut this presumption. The question of survivorship is one of fact, each case being taken on its own merits as far as the proofs are concerned.

DEATH

If a person goes abroad and is not heard of for seven years by those who would be likely to hear from him if alive, the law presumes his death, but not the date of it. That death took place at any particular time within the seven years must be proved by the person to whose claim that fact is essential.

Cessation of respiration and circulation, or fall of the internal temperature to 68° F., or coagulation of the blood in the vessels, or rigor mortis, or putrefaction, is **an absolute sign of death**; that is, when one of these conditions is established beyond dispute, no further proof of death is needed.

Life cannot exist if **respiration** and **circulation** have ceased for five minutes, but in some cases frequent examinations may be necessary before their cessation can be positively asserted. If respiration has ceased, no respiratory movements are seen or felt, nor are breath sounds heard on applying the stethoscope to any part of the chest. Proofs in the form of the fixation of a bright image reflected from a mirror placed on the thorax or abdomen, or the absence of rhythmic dimness on a piece of glass or polished steel held before the nostrils and mouth, are superfluous. When the heart stops beating, circulation is, of course, at an end; but it may be so feeble that the heart sounds cannot be heard, nor can pulsation be felt anywhere. It does not continue to beat longer than four or five minutes after respiration has ceased.

The body **temperature** begins to fall at death, if not before; but it may rise after death, as in tetanus, small-

pox, and cholera. The fall is said to be at the average rate of 1° F. per hour until the temperature reaches, or almost reaches, that of the surrounding medium, which it usually does in fifteen to twenty hours. But the fall is more rapid during the first few hours than later, and, like other heated bodies, it is affected by the presence or absence of covering, the conducting power of the substance with which it is in contact, and the temperature, movement, or stillness of the surrounding air.

The blood may begin to coagulate in the vessels as early as four hours after death, but often not until a much later period. If **coagulation of the blood** has occurred, circulation must have ceased and death have taken place.

Post-mortem stains on the surface of the body are due to gravitation of the blood before it has coagulated; therefore they are formed on dependent parts, and their existence elsewhere suggests a change in the position of the body since their formation. The red patches, on non-dependent parts of the body, in carbonic oxide poisoning can be distinguished by a spectroscopic examination of the blood. Ecchymoses produced by injuries before or immediately after death may resemble post-mortem stains; but the latter can usually be distinguished by observing that they are not above the level of the surrounding skin, their surfaces are not injured, and the blood is not, at first, exuded from their capillaries.

Rigor mortis or stiffness of the muscles after death, probably always occurs, and is due to coagulation of muscle plasma, and, to some extent, to actual contraction. As a rule, it sets in within six hours, and passes off within forty-eight hours, after death. It appears earlier in the involuntary than in the voluntary muscles. Usually early

and late onset are followed by short and prolonged duration respectively. It begins as electrical irritability passes off; consequently, the time of its onset varies with the duration of muscular irritability, which in turn is in proportion to the degree of irritability at death. It appears and disappears in the different parts of the body in the same order, first in the neck and lower jaw, extending to the face, then in the arms and trunk, and finally in the legs. It is distinguished from vital rigidity by flexing or extending one of the affected limbs. When the force is withdrawn, in rigor mortis the limb retains its new position for some time at least; but in vital rigidity it resumes its former condition.

Putrefaction or decomposition alters the chemical composition and physical characters of the tissues. It is caused by the action of bacteria, and follows, but never precedes, rigor mortis; therefore its onset is variable. It is favoured by heat, moisture, free access of air, and by the state of the body due to certain causes of death, *e.g.*, asphyxia and septicæmia. On the other hand, it is retarded by cold, absence of moisture, prevention of free access of air, and in poisoning by arsenic, corrosive sublimate and some other substances.

Its earliest indication on the surface occurs in one to three days after death, usually as a greenish patch at the umbilicus. On the fifth to the sixth day this patch is deeper in colour and more extensive; the development of gases in the abdomen causes pressure of blood to the head, protrusion of the tongue and eyeballs, and oozing of blood-stained frothy fluid from the mouth and nostrils. At the end of the first week the green patch has greatly extended, there are smaller ones elsewhere, and some of the superficial veins may appear as red lines. In the

second week the abdomen is very much distended with gas, the lines of the superficial veins are well marked, and the sphincter ani is relaxed. In the third week the face is so swollen that the features are obliterated; brownish patches exist on several parts of the body, which has an enlarged appearance through inflation of the cellular tissue; the epidermis is raised in blisters, the hair is loose, and the nails are easily detached. After a very variable period, perhaps three or four months, the abdomen and thorax burst, the cranial sutures give way, the contained organs escape, and general dissolution takes place. The gases of putrefaction may produce movements of the body resembling those due to vital action.

The post-mortem changes of loss of muscular irritability, rigor mortis, and putrefaction, occur in the order here given, but they are not sharply separated. Rigor mortis may be present although irritability has not completely passed off, and it may continue into the stage of putrefaction.

Saponification may occur instead of the putrefactive decomposition just described. It is a process which results in the production of adipocere, a kind of soap formed by the combination of ammonia (from decomposing nitrogenous tissue) with the fatty acids, and requires water as an essential factor. In this country adipocere may be formed as early as the third month in bodies lying in water, and in twelve months in those buried in damp soil.

Mummification, or drying, occurs in bodies placed in a medium so dry that it rapidly removes the moisture from the tissues, which retain their shape although they are much reduced in size.

As post-mortem changes are affected in their onset and progress by many conditions, *e.g.*, the cause of death, the surroundings, and the season of the year, only a qualified and approximate calculation can be made of the length of time since death. Often no opinion at all can be given.

MODES OF DEATH

For convenience of classification it is customary to divide the modes of death into those that begin at the Heart, at the Lungs, and at the Head.

As far as the medical jurist is concerned, the most important conditions immediately dependent on the circulation are **hæmorrhage** ; **shock**, or collapse, in which there is dilatation of the vessels of the viscera, and, although the heart may continue to beat, there is very little blood in circulation ; **syncope**, or fainting, in which there is feeble action of the heart and diminished blood-pressure in the brain, with loss of consciousness. The contracted and empty state of the heart after death by syncope may be due to rigor mortis.

The principal condition resulting from obstruction of the respiratory process is **asphyxia**, due to prevention of aëration of the blood and defective elimination of carbonic acid from it. Asphyxia begins with difficult breathing, increasing to violent efforts at respiration ; the vascular tension is increased, and the surface of the body becomes livid ; unconsciousness comes on early ; the respiratory efforts are replaced by general convulsions, and the heart stops in diastole after convulsive and respiratory movements have ceased. Post-mortem, the blood is dark, coagulates slowly, and contains excess of carbonic acid ; the left side of the heart may be empty through rigor

mortis, but the right side, the venæ cavæ and the pulmonary artery are gorged with blood.

When the head is injured, or the functions of the brain are disturbed by disease, the fatal condition known as **coma** is liable to follow. If this is profound, there is complete insensibility and unconsciousness, respiration is stertorous, and death may be preceded by convulsions. The appearances after death are not constant; usually those of asphyxia are present to some extent, and an examination of the brain may reveal indications of the cause.

POST-MORTEM EXAMINATIONS

A post-mortem examination can be made by order of the coroner, and he, or the Home Office, or the High Court, can order a body to be exhumed and examined. A medical man implicated in the case must not be present at the examination, but he may be represented at it by another practitioner who must not take an active part in its performance.

When a body is exhumed, if the coffin is decayed, it is well to remove a little of the surrounding earth for chemical analysis if mineral poisoning is suspected. The examination should be made in daylight, be as thorough as possible, and extend to the whole of the body. It is not enough to examine the part only in which the fatal injury or disease is believed to exist, since a probable cause of death in another part may be suggested, and even discovered. If the body is seen by the examiner where it is found, he should note its position and surroundings.

Before proceeding to open the cavities, it is necessary to take the temperature; to observe the general condition with regard to the state of nutrition, and rigor mortis, putre-

faction or any other post-mortem change ; to determine the position, direction, and extent of wounds and other injuries ; and, in the case of an unknown person, to note all the points that are important in establishing identity. If the bladder contains urine, it should be drawn off and examined.

The abdomen should be opened first, then the thorax, and lastly the cranium, unless there is something in the history of the case or in the condition of the body to vary this order.

An incision along the anterior median line from the chin to the symphysis pubis serves for the opening of the abdomen and thorax. After the former has been opened and the appearances of its contents, as well as the position of the diaphragm, have been ascertained, the thorax can be opened by reflecting the soft parts sufficiently to remove the sternum and costal cartilages by separating the sterno-clavicular articulation and cutting the cartilages at their union with the ribs. When the general appearances of the contents of the thorax have been noted, it is advisable to expose the surface of the brain to observe the degree of congestion of its vessels, before proceeding further with the examination of the abdominal and thoracic viscera.

To open the cranial cavity, an incision is made through the scalp, extending between the bases of the mastoid processes ; the soft parts are then reflected anteriorly and posteriorly, and the calvarium removed by sawing transversely through the external table and chiselling through the internal table at the level of an inch above the margin of the orbit, extending back to a level with the occipital protuberance.

The contents of these cavities can now be examined and removed if necessary for more complete investigation.

Care should be taken to note the appearances and quantities of fluids the cavities contain. Parts to be kept for chemical examination should be put into clean glass jars without any preservative or antiseptic, and at once corked, sealed, and labelled. The incisions necessary to remove part of the alimentary canal should be made between ligatures, in order to prevent the discharge of any of its contents.

The alimentary canal from the lips to the stomach, and the air-passages, should be examined for the action of corrosive poisons, and for foreign bodies or pathological conditions capable of obstructing respiration, especially when a satisfactory cause of death cannot be found elsewhere. They can be reached by reflecting the soft parts sufficiently in front of the neck and at the lower jaw.

To open the spinal canal, an incision is made along the posterior median line, over the spinous processes; the soft parts are reflected on each side; the laminæ are then sawn through close to the roots of the transverse processes, and the separated arches removed.

Of course, every diseased condition or injury in the limbs or elsewhere requires as careful examination as the contents of the cavities.

Where an inquest is not to be held, the Anatomy Act authorizes the executors or other persons having lawful possession of the body to permit an anatomical examination of it.

IDENTITY

The question of identity usually arises in criminal cases, in disputed claims to titles and property, and with regard to persons found unconscious or dead.

The most important points in establishing identity in the living are sex, age, height, general physical appearances, deformities, hair, scars and marks on the skin ; and in addition to these, in the dead, the skeleton.

In the living the probable difficulties in determining the **sex** are referred to under Hermaphroditism. In the dead it can be determined by the skeleton if the genital organs are destroyed.

The estimation of **age** is assisted by several anatomical conditions, including the state of the teeth and the bones. The teeth generally appear at the following ages, proceeding from the middle line : the milk teeth—in the seventh, ninth, eighteenth, twelfth, and twenty-fourth month ; the permanent teeth—in the eighth, ninth, twelfth, tenth, eleventh, seventh, fourteenth, and eighteenth to thirtieth year. As a rule, the skin of the face shows some wrinkles as early as thirty years, the hair begins to whiten at the temples at about thirty-five, the arcus senilis seldom appears before sixty, and the nails are dry and brittle in the very old.

The **height** of a person while standing may be as much as an inch less than his length while lying. It is less in the evening than in the morning if the erect posture has been maintained during the day, and it is diminished by fatigue.

The **general appearances** may be characterized by deformities, either congenital or due to injuries or other causes, or by the effects of occupations causing pressure on certain parts of the body, or requiring assumed positions or the use of special implements or materials.

In the **hair** the principal points for observation are its colour and extent. If the colour is artificial, the dye may be found evenly distributed or changing abruptly to the

natural colour which appears at the roots after a few days' growth. Bleached hairs become brittle, and if chlorine has been used the odour of this gas is given off. A chemical analysis may be necessary to decide the presence and nature of a dye.

The colour of the **eyes**, the direction of lines drawn through their angles and meeting in the middle line, the form and position of the eyebrows, and the shape of the ears, nose, and mouth, may be important proofs with regard to identity, especially if there are portraits for comparison.

A **scar** is probably always permanent if it is due to complete division of the true skin. But it may disappear in time if the division is incomplete, the incision linear, and healing accomplished by first intention. The length of time required for the formation of a scar depends on the nature and extent of the injury, and other conditions. It is often formed within a fortnight. At first it is softer and redder than the surrounding skin, but after a variable period, frequently two or three months, it loses its blood-vessels, and, having passed through a stage of brown discoloration, acquires a hard, smooth, shining, white appearance, which is more apparent after pressure. In this state nothing more definite can be said about its age than that it has probably existed a few months at least. Scars are left after the removal of moles and nævi.

Tattoo marks are, as a rule, permanent, especially if they have been made with Indian ink or gunpowder or other material containing carbon. Those that disappear are superficial, or the colouring matter is soluble or consists of very fine particles which are absorbed and deposited in the nearest lymphatic glands. The designs may suggest either the occupation or the habits of the

individual. If attempts have been made to efface them, the resulting scars may indicate their outline.

Finger-prints differ in each individual in the designs formed by the ridges and furrows on the skin on the anterior and inner surfaces of the terminal phalanges. These designs remain the same throughout life, and are sufficient to establish identity, if there are previous prints for comparison.

For identifying prisoners, certain **measurements** of the body are made which are characteristic of the individual, since practically the dimensions of the bony framework are fixed after the twentieth year, and the measurements, taken together, are not the same in any two individuals. Those usually made are: the height of the whole body when upright and seated; the span of the extended arms between the tips of the middle fingers; the length and width of the head and right ear; and the length of the left forearm, middle and little fingers, and left foot.

Much can be learned from **the skeleton**. Complete or in part, it may be all that is left to rely on for identity.

The bones in the male are larger and heavier, the tuberosities and surfaces for insertion of muscles are more marked, the skull has greater capacity, and the lumbar curve is less than in the female. In the pelvis of the adult female the brim and outlet are larger, the lumbo-sacral angle and the curvature at the lower part of the sacrum are greater, the angle of the symphysis is more obtuse, the foramina are more triangular, the acetabula are more apart, the cavity is wider, shallower, and altogether of greater capacity than in the pelvis of the adult male.

The age may be indicated by the teeth, as already described; or by the extent of ossification, which is usually

complete at thirty years ; or by the condition of the lower jaw. At birth the body of the lower jaw consists chiefly of the alveolar portion ; it is semicircular, and forms an obtuse angle with the ramus. In adult life this angle has become less obtuse and approaches a right angle ; the body consists of basal and alveolar portions, and is more horseshoe-shaped than semicircular. In old age the angle formed by the body and ramus is again obtuse, and the alveolar portion has atrophied, the body being almost completely basal.

The length of the skeleton is about an inch and a half less than the height of the individual. Although the relation between the length of each of the long bones and that of the skeleton is not fixed, it is sufficiently constant to assist in estimating the height. To this end tables have been constructed.

The skeleton may present deformities or indication of fractures or disease which the individual is known to have had.

The occurrence of **impressions or prints by the hand or foot**, bare or covered, may be very serviceable in establishing identity. Impressions can be copied by casts, and prints by tracing them on paper.

A cast may be made by smearing the impression with oil and then filling it with plaster of Paris made into a cream with water ; or, if the impression is not dissolved by heat, by holding a hot iron over it until it is sufficiently warmed, and then sprinkling it with powdered paraffin wax, the process being repeated until the cast is sufficiently thick.

Whether a given piece of animal tissue is human or not can usually be determined if it is large enough and its characteristics are preserved.

BLOOD

may present itself for examination in conditions varying from a large, fresh effusion to an old, dry, scarcely perceptible stain.

The chief points to observe are its position, quantity, condition (whether coagulated or liquid), colour, and, if in sufficient bulk, its temperature. A **blood-stain** a week old may have the same characters as one at any greater age. Its change in colour from red to brown occurs very early in the impure air of a manufacturing town. The situation and shape of a stain may be affected by the source of the blood. The flow from an artery is jerky, and varies in force with that of the pulse; from a vein it is regular, but less forcible, and therefore shed at a shorter distance than from a corresponding artery.

Blood is easily recognised when it is fresh and in bulk; but in the form of dry stains on weapons, clothes, articles of furniture, and other substances, tests are necessary to distinguish it from iron and fruit stains or other colouring materials. A recent blood-stain can be dissolved in cold distilled water; an old one, or one on steel, dissolves in a cold saturated solution of borax containing a few drops of solution of ammonia.

If fresh blood, or a solution of the colouring matter of a recent blood-stain (obtained by placing a small piece of the stain in a little glycerine and water—1 to 10), is examined under the microscope, **red blood-corpuscles** are seen. In all mammalia, except the camel, the red corpuscles are non-nucleated and round; in the camel they are non-nucleated and oval; in birds, reptiles, fishes, and am-

phibians they are nucleated and oval. These characters may be sufficient to confirm or refute statements with regard to the source of blood found on an accused person or elsewhere ; but the corpuscles may be so far altered or destroyed that they cannot be relied on.

If the quantity of blood is small, it should be examined by the spectroscope before chemical tests are applied. The **spectra** of oxyhæmoglobin, reduced hæmoglobin, and reduced hæmatin, taken together, are characteristic of blood, and distinguish it from all other colouring matters.

The spectrum of a dilute solution of fresh blood consists of two dark bands, one on the violet side of the solar line D, the other on the red side of the solar line E—the spectrum of oxyhæmoglobin.

If the blood is not quite fresh, or is deoxidized by a reducing agent, *e.g.*, sulphide of ammonium, there is only one band, which extends from D to E—the spectrum of reduced hæmoglobin, which changes or reverts to that of oxyhæmoglobin when the solution is shaken up with air.

Reduced hæmatin gives the most sensitive and pronounced spectrum. This substance can be formed from oxyhæmoglobin by treating it, first, with a few drops of strong solution of caustic potash, producing alkaline hæmatin, and then with a few drops of sulphide of ammonium ; or by adding a little sulphide of ammonium to old blood in which acid hæmatin has been naturally formed. The spectrum consists of two bands, one midway between D and E (occupying the position of the space left between the bands of the spectrum of oxyhæmoglobin), and the other, less defined, on the red and violet sides of E.

The **hæmin test** is the most conclusive chemical test for the presence of blood. It depends on the action of nascent hydrochloric acid, which results in the formation of crystals of hæmin—hydrochlorate of hæmatin.

To apply this test to a stain on cloth, on a small piece of the stain, placed on a microscope slide, put a minute crystal of sodium chloride, and saturate the fabric with glacial acetic acid; then thoroughly mix the acid with the colouring matter by means of a glass rod, express the fluid on to the slide, put a cover-slip over it, and boil it to dryness by passing it through the flame of a Bunsen burner. Examined under the microscope, crystals of hæmin are seen, brown by transmitted light, but steel blue by reflected light, mostly in the form of rhombic plates. This test can be applied to a solution of a blood-clot evaporated to dryness on a slide.

The **guaiaicum test** depends on the combination of nascent oxygen with guaiaicum in the presence of blood, and can be applied to a solution of the red colouring matter of blood by adding a drop or two of tincture of guaiaicum and then a solution of peroxide of hydrogen, when a blue colour appears. Other substances give a blue colour with these reagents; but it is said that blood is the only red colouring matter a solution of which immediately turns blue on the addition of peroxide of hydrogen after treatment with tincture of guaiaicum.

The differences in odour, size of the red corpuscles, quantity of iron, and length of time necessary for coagulation, in the blood of different species of mammalia are not sufficiently fixed and observable to determine the species from which a given specimen of blood has been obtained; but it has been proposed to distinguish fresh blood by crystallizing the hæmoglobin in the presence of putrid

serum. In man and monkeys the crystals so obtained are plates of reduced hæmoglobin, which are almost always rectangular in the former, but mostly diamond-shaped in the latter. In the lower animals the crystals are oxy-hæmoglobin.

ECCHYMOSES

are effusions of blood into the skin and subcutaneous tissue, chiefly from ruptured capillaries. They are usually caused by abrupt contact with a hard substance, as by a blow with the fist or a fall on a stone pavement.

An ecchymosis may not appear immediately after the injury; sometimes it is completely absent, although the force has been sufficient to injure the parts beneath. Its extent is likely to be in proportion to the violence of the contact and the laxity of the tissues, and its shape may indicate the substance or weapon that caused it. In some cases it appears at a distance from the area of contact.

The colour is, at first, red if the effusion is rapid, but blue if it occurs gradually. Within twenty-four hours, as a rule, the edges become paler than the centre, and the whole gradually passes through green, yellow, and lemon colour, the changes extending from the margin to the centre. In a healthy individual an ordinary bruise disappears inside a fortnight, but its duration may vary from a few days to a few weeks.

Ecchymoses in a dead body showing colour changes or signs of inflammation must have occurred during life. Those produced immediately before and after death may be so similar that they cannot be distinguished from each

other. Although an effusion of blood may follow a blow applied to a dead body two or three hours after death, it is most probably only into the subcutaneous tissue, not into the true skin.

Spontaneous blood effusions into the skin and subcutaneous tissue are liable to occur during life in certain diseases, *e.g.*, purpura. Cadaveric lividity may resemble ecchymosis, but, as elsewhere pointed out, the former are usually in dependent parts, and the blood is contained within the vessels for some time.

HOMICIDE

is the killing of one human being by another, by shooting, striking, drowning, poisoning, negligent omission, or any other means.

It may be homicide to inoculate a person with plague or other disease of which he dies. But it is not homicide, in the legal sense of the word, to kill a child before it is completely born. A person commits homicide if death is due, not directly to the injuries he has inflicted, but to a cause resulting from them, such as a surgical operation performed with common knowledge and skill, and at the time believed by competent surgeons to be necessary.

It is a good defence to a charge of homicide that the deceased survived his injuries a year and a day. But the existence of a fatal disease is no defence, unless it can be shown that death was due to the disease, and was not hastened by the act or omission of the accused.

When homicide is unlawful and with malice afore-

thought, it is **murder**, for which the punishment is death.

Take an illustration from Stephen's 'Digest of the Criminal Law': If A knows that B is suffering from disease of the heart, and, intending to kill him, gives him a slight push, and thereby kills him, A commits murder.

A person is guilty of murder if he persuades another to kill himself, and he does so ; or if he agrees with another that they should commit suicide together, and he survives but the other dies.

Every person who kills another is presumed to be guilty of murder if the circumstances of the case do not raise a contrary presumption. The attempt to commit this crime is a felony punishable by penal servitude for life.

When homicide is unlawful, but without malice aforethought, it is **manslaughter**, a felony punishable by penal servitude for life.

Take another illustration from Stephen's 'Digest': If A strikes at B with a small stick and kills him, although he did not intend either to kill him or do him grievous bodily harm, A is guilty of manslaughter.

If a person attempts to commit suicide, by drowning, for example, and another loses his life trying to save him, the former is guilty of manslaughter.

Suicide is not a proof of insanity. At law a person commits a felony when he kills himself deliberately or in an attempt to kill another. Formerly he was buried in the highway without Christian rites, and his goods and chattels were forfeited to the Crown. Now, apart from a life insurance policy, the only effect is denial of Christian burial according to the rite of the Church of England.

It is a misdemeanour to attempt to commit suicide, and the punishment can extend to two years' imprisonment.

An examination of a dead body, in case of homicide, must not be confined to the seat of the alleged fatal injuries, but must extend to every part of the body, in order to discover or exclude any other probable cause of death, either violent or natural. If there are two or more injuries, it is necessary to compare them with regard to their time of infliction, position, and extent, and if possible to determine which of them was fatal, especially if they have been inflicted by different persons. If death does not take place for a considerable time after an alleged injury or neglect, it may be difficult, or even impossible, to decide whether the cause was criminal or natural. Opinions on these questions must be based on general surgical and medical experience. No definite guiding rules can be laid down.

All wounds or other injuries that a suicide can inflict can be homicidal. When wounds are suicidal, they are usually in the front of the body, and are incised or punctured; if firearms are used, they are most frequently discharged into the mouth, temples, and chest. Injuries in parts of the body difficult of access, or contusions, are homicidal in most cases; but the insane may commit suicide by injuries in situations suggesting homicide, or even by blows producing contusions, or by other unusual methods. Numerous wounds do not exclude suicide, nor do more than one mortal wound, since a wound to be mortal need not be immediately fatal; sufficient time and strength may be left to inflict another.

Suicidal throat-cuts are, usually, in part of their course

between the hyoid bone and thyroid cartilage. They extend from above down, in right-handed persons from left to right, but in left-handed persons from right to left. Homicidal throat-cuts are mostly horizontal, but they may resemble those inflicted by suicides. If, in addition, the hands are badly cut, the case is more likely homicidal than suicidal, but severe cuts may be found in the hands in suicides.

Stabs in suicides are usually directed from above down, in right-handed persons from right to left, but in left-handed persons from left to right. If their direction is from below upwards, they are, as a rule, homicidal.

If a wound shows any sign of vital action, such as healing, or formation of pus, it must have been received during life. Wounds inflicted shortly before and after death cannot be distinguished, as they are capable of having the same characters, namely, retraction and eversion of their lips, effusion of blood which coagulates, contusion of the surrounding tissues, and absence of pus or signs of healing. If they are inflicted several hours after death, their lips are not everted, the effused blood, if any, is venous, usually fluid, and does not coagulate, and there are no contusions.

ASSAULTS, WOUNDS, AND OTHER INJURIES

A **common assault** is an unlawful attempt to inflict an injury on another, as when a person strikes at another with his fist or stick, as near as would enable the blow to take effect. Words alone cannot amount to an assault.

If the least actual force is applied in an angry, hostile, revengeful, rude, or insolent manner, the offence becomes a **Battery**.

The punishment for these misdemeanours is one year's imprisonment, but if there is actual bodily harm it can extend to five years' penal servitude.

To unlawfully and maliciously wound or inflict any grievous bodily harm upon any other person, with or without any weapon or instrument, is a misdemeanour liable to five years' penal servitude; but to wound or cause any grievous bodily harm to any person by any means whatsoever, *with intent* to maim, disfigure, disable, or do some other grievous bodily harm to any person, is a felony punishable by penal servitude for life.

A wound, at law, means a division of the surface of the body, external or internal. Division of the epithelium is not enough; there must be division of the true skin or mucous membrane. An injury causes **grievous bodily harm** when it interferes with health and comfort, although it is neither dangerous nor permanent. **To maim** is to inflict such an injury on a man's body as to render him less able to fight.

Every wound or other injury should be carefully examined with regard to its position, size or extent, shape, direction, general condition, and relation to injuries to clothes, not only for the purpose of giving an exact description of it, but also to enable the examiner to form an opinion, if possible, as to its probable danger to life, its cause, whether it was self-inflicted or otherwise, the length of time since it occurred, and, if there are two or more, their relative gravity.

Prognosis must be guided by general, not by exceptional, surgical experience. Of course, tetanus and erysipelas

may follow the slightest injuries, and recovery may occur in apparently hopeless cases; but these results ought not to be the basis of an opinion on the degree of danger to life of a given injury.

A discussion of the prognosis of the injuries likely to be inflicted is beyond the scope of this book. Prognosis is more properly dealt with in works on surgery, to which reference must be made if necessary.

According to the medical report, based on an examination to determine whether an injury is dangerous to life or not, an accused person may be detained in custody or liberated on bail.

GUNSHOT WOUNDS

Projectiles produce lacerations and contusions of the tissues they pass through or come in contact with, and, so far, resemble lacerated or contused wounds caused by other means.

If a **round bullet** has been used, the entrance wound is usually round or oval, inverted, and appears smaller than the bullet; but the exit wound is larger and everted.

If the bullet is small, **conico-cylindrical**, and at high velocity, the entrance and exit may be similar in shape and size, and the tissues through which it passes are not injured to the same extent as by a round bullet.

The examiner should carefully note the general characters, position, and direction of the wound, and the nature, position, and condition of the weapon. Homicide is suggested, but not proved, by the entrance wound being in the posterior part of the body. The case is probably suicidal if the weapon has been discharged into the

mouth, temples, or chest, or is firmly grasped in the hand of the deceased. Grains of shot or powder are found scattered in the body according to the distance at which the weapon was discharged. If the clothes or skin show the effects of ignited grains of powder, it must have been discharged close to the body.

The presence of a gunshot wound or any other injury due to firearms does not necessarily indicate that death was caused by it; poisoning or some other form of violence may have been the real cause. Therefore in this, as in all other cases, the post-mortem examination must be thorough.

RAPE

is the crime of having carnal knowledge of a woman against her will, or without her conscious permission. It is a felony punishable by penal servitude for life. To complete the crime, the penis must enter the vulva, but neither entrance into the vagina nor emission of semen is necessary.

It is rape to carnally know a woman in a state of insensibility or by personating her husband; or an idiot if she, by reason of her idiocy, submits, but does not permit the act; or a common prostitute or a concubine against her will.

If rape cannot be proved, the accused may be convicted of the attempt, or of an indecent assault, which are misdemeanours punishable by imprisonment for two years.

A husband is not guilty of a rape upon his wife if he carnally knows her himself, but he can be convicted of aiding and abetting another in committing the crime. A boy under fourteen years is presumed to be unable to commit rape, and this presumption cannot be rebutted

even by proof of his ability. He may, however, be convicted of aiding and abetting another to commit the crime, or of an indecent assault.

To carnally know, *with consent*, a girl under thirteen years is a felony punishable by penal servitude for life. To attempt to know a girl under thirteen years, or to have carnal knowledge, *with consent*, of a girl between thirteen and sixteen years, is a misdemeanour punishable by two years' imprisonment; but if she is more than thirteen, and the accused can show that he had reasonable cause to believe she was sixteen, he will be acquitted. Consent after sixteen years of age does away with the legal offence.

It is possible to have connection with a woman without her knowledge, *e.g.*, if she is in deep sleep (if she has been accustomed to the act), or, of course, if she is under the influence of a narcotic or an anæsthetic. One man can overcome a woman so as to commit a rape on her if she is so weak that her resistance is feeble, or if he renders her powerless by injuries or fright.

A cryptorchid can commit this crime. Pregnancy can follow it, but does not prove consent.

Although rape can be proved without the aid of medical testimony, a medical examination of the prosecutrix and accused may be required. The examiner should place no reliance on their statements, nor should he make an examination until he has obtained their full consent and they have been cautioned that the results may be given in evidence at the trial. He should carefully search for and examine all injuries, discharges, and stains in and about the genitals or elsewhere.

A medical examination cannot prove or negative rape, but it may supply strong corroborative evidence in favour

of it, or be sufficient to prove that connection has occurred.

The conditions frequently found after forcible connection—bruises, abrasions, lacerations, bleeding, vaginal discharges, and semen—can all be due to other causes, or to connection with consent. On the other hand, nothing whatever may be found, even immediately after a rape has been committed—a condition which can exist if the woman is helpless or unconscious. Moreover, the injuries due to rape may disappear in a few days.

The state of the **hymen** proves nothing absolutely with regard to rape. If it is imperforate, penetration into the vagina cannot have occurred, but this is not necessary to complete the crime. If it is perforate, it is possible for it to remain intact after connection, as it has been necessary to incise it at parturition. If it is ruptured, this is not necessarily due to connection.

Discharges may occur in young children with aphthous ulcerations resulting from vaginitis. Leucorrhœal discharges may resemble those due to gonorrhœa; but gonococci may be found in the latter, which differ from discharges produced by injuries by not appearing until four or five days have elapsed after the alleged cause, and by being more profuse and of longer duration.

Although the absence of **semen** does not negative rape, its presence may be strong corroborative evidence of this crime. If it is found in the female genital canal, the presumption is that connection has occurred as far as the vulva at least, but not, of course, that it was by the accused or without the consent of the prosecutrix.

The only positive proof of semen is the existence of complete spermatozoa, but their absence does not exclude

semen, as they are not always present, and they may have been destroyed. In searching for spermatozoa, put a small portion of the fluid or of the mucus from the vulva or vagina on a microscope slide, apply a cover-glass, and examine with a quarter-inch or sixth-inch objective.

To examine a stain, first place one end of it in a very weak solution of hydrochloric acid (1 drop of acid in 40 c.c. of distilled water) on a watch-glass, and let it remain until it is thoroughly softened. This may require from a few minutes to a few hours, according to the age of the stain. It is then removed and dabbed on a slide, which can be examined with the microscope. It is necessary to treat the stain gently to prevent damage to the spermatozoa.

As the plea of impotency may be put forward by the accused, it is necessary to examine for any disease, abnormal development, or injury capable of preventing penetration into the vulva.

SODOMY

is the crime of knowing any man or woman *per anum*. Both parties, if consenting, are equally guilty—males if above fourteen years, and females if above twelve years. **Bestiality** is applied to the crime of carnal knowledge by man or woman in any manner with one of the lower animals. Both sodomy and bestiality are felonies punishable by penal servitude for life.

To complete the crime of sodomy there must be penetration of the anus, but emission of semen is not essential.

Every person who is guilty of an assault with intent to commit sodomy, or of an indecent assault upon any male

person, is guilty of a misdemeanour, and liable to ten years' penal servitude.

Examination of the anus and rectum of the passive agent may discover lacerations or other injuries, or semen, or signs of venereal disease. In those who have habitually committed the crime relaxed sphincter ani and incontinence of fæces may exist. The active agent may be soiled by the contents of the rectum. But an examination of both parties may be completely negative, although it is made very soon after the crime has been committed.

In bestiality the examiner should search for semen on the animal and hairs on the accused. If these are found, and if the hairs are the same as those of the animal, they form very strong corroborative evidence of the crime.

ABORTION

At law, **abortion** and **miscarriage** are synonymous words, and mean the expulsion of a fœtus at any time before complete gestation.

A woman *with child* who unlawfully administers to herself any poison or other noxious thing, or uses any instrument or other means whatsoever, with intent to procure her own miscarriage; or any person who unlawfully administers, or causes to be administered, any poison or other noxious thing, or uses any instrument or other means whatsoever, with intent to procure the miscarriage of any woman, *with or without child*, is guilty of felony, and liable to penal servitude for life.

Any person who supplies or procures any poison or other noxious thing, or any instrument or thing whatsoever, knowing that it is intended to be unlawfully used, or with the intent that it shall be unlawfully used to

procure the miscarriage of any woman, *with or without child*, is guilty of a misdemeanour, and liable to three years' penal servitude.

Neither miscarriage nor the power to produce it by the means employed is necessary to complete these offences.

Although a woman *not with child* cannot be convicted of attempting to procure her own miscarriage by using any means upon herself, yet she may be convicted of conspiring with other persons to procure her own miscarriage.

It does not appear to be an offence to use any means whatever to produce the expulsion of a mole or other product of conception not a child.

Although the word 'unlawfully' in the statute is believed to exempt abortion by a qualified medical man for the purpose of saving the life of the mother or child, such abortion is not specifically recognised by law. It is therefore expedient, in every case in which abortion is necessary, to obtain the approval and assistance of another medical practitioner, and also to avoid undue secrecy.

The attempts to procure criminal abortion are usually made during the second, third, and fourth months, rarely after the sixth month, of gestation. Many mechanical means are used, such as bougies, catheters, pointed and cutting instruments, either alone or with the internal administration of drugs. Consequently, injuries, more or less serious, are very liable to be inflicted on the genital canal and adjacent parts.

Among the many substances given internally to produce abortion are ergot of rye, savin, pennyroyal, yew, rue, tansy, purgatives, cantharides, arsenic, tartar emetic, phosphorus, and salts of iron. Ergot is the only one capable of acting directly on the uterus; but some observers consider that it cannot do more than increase

the natural contractions of this organ. It frequently fails to produce abortion. Any effect that the other substances have on the uterus is secondary to general shock or gastro-intestinal irritation. If abortion results from their use, the woman almost always dies from their toxic effects.

Of course, abortion is frequently unintentional, and due to many non-criminal causes, *e.g.*, diseases of the mother or foetus, accidental injuries, and shock.

As the signs of abortion are those of delivery, they are more distinct the more advanced the stage of gestation and the earlier the examination.

In an examination during life, the examiner should search for and note all injuries, instruments or other means said to have been used, substances stated to have been expelled from the uterus, and the presence or absence of signs of pregnancy or delivery. Post-mortem, the stomach and bowels may reveal the irritant effects of drugs given as ecbolics, and the genital canal may be found injured, or present the conditions due to gestation or delivery.

INFANTICIDE

is the killing of a new-born child, and is the same as homicide at any other period of life. It cannot be committed on a child before it is legally, that is, completely born.

A person is guilty of murder if he unlawfully produces abortion, and the child dies from premature birth. If he inflicts injuries on a child before birth, from the effects of which it dies after birth, it seems always to have been the better opinion that he commits murder. A woman is guilty of murder if she makes up

her mind that the child shall die, and, when it is born, she leaves it with the intention that it shall die, and it dies in consequence. She is guilty of manslaughter if, without intending the death of the child, she determines to be alone at the birth for the purpose of temporary concealment, and the child afterwards dies by reason of her negligence.

The methods usually employed by infanticides are, in order of frequency, suffocation, strangulation, immersion in privies, drowning, injuries to the head and other parts of the body, neglect, and, in very rare cases, poisoning.

All these causes of death can occur unintentionally, and this is the usual plea of the accused. Suffocation and neglect may be due to the inability of the mother, when alone, to prevent them ; strangulation can be produced by the cord round the neck ; immersion in privies and drowning can result from the effort of the mother to urinate or defæcate during parturition ; and injuries can be due to falls and other accidental causes after birth, as well as to difficult labour. Moreover, it must not be forgotten that new-born children may die from congenital malformations and diseases.

At this, as at any other period of life, it may be, and often is, impossible to decide from an examination of the dead body whether the cause of death was intentional or not.

The presumption of intentional homicide arises if a poison is found in the body, and it cannot be shown that its administration was with good intent, and is approved of by competent authority.

The law presumes every child to be born dead until the contrary is shown. Therefore in a trial for infanticide it is for the prosecution to prove live-birth. This may be

done by non-medical witnesses proving that the child breathed, cried, or showed some other indication of life after it was born. But this proof may be defective or wanting, and in any case a medical examination of the dead body may be required to determine, if possible, whether the child was born dead or alive, and of the alleged mother, to ascertain whether she has been recently delivered or not.

The chief points for the examiner to note are: the heat of the body; the state of the surface; the nature of the injuries, if any; the probable uterine age; the condition of the body generally, but particularly with regard to rigor mortis and putrefaction; the state of the lungs, alimentary canal, bladder, middle ear, ductus venosus, foramen ovale, ductus arteriosus, and umbilical cord; and the nature of any malformation or pathological condition that may be present.

The presumption of still-birth is confirmed by the uterine age being so early that the child could not have been born alive; or, if the exact time of birth is known, and the examination is made soon after birth, by the presence of putrefaction at a stage which shows that it must have begun before birth.

Rigor mortis, *per se*, proves recent life and recent birth, but neither still- nor live-birth.

There is no absolute proof of live-birth to be obtained from a post-mortem examination of a *new-born* child. Each of the proofs that have been relied on from time to time is open to some objection, which must be removed before the proof can be accepted.

The presence of air in the lungs does not prove live-birth, since breathing can occur before complete birth, air can enter the vesicles through artificial inflation, and

there is no certain method of determining, by examining the lungs of a new-born child, whether the air found in them was due to natural respiration or artificial inflation, or, if the latter can be excluded, whether the former was before or after birth.

Before respiration, the lungs occupy the posterior part of the thorax ; they have a uniform chocolate colour and a smooth, solid, homogeneous appearance. The diaphragm is usually as high as the fourth or fifth rib.

After respiration, they project to the front of the chest cavity, present a marbled appearance, have a lighter and more reddish colour and greater absolute weight but less specific gravity than before, are covered with fine vesicles, crepitate when pressed between the fingers, and are spongy on section. The diaphragm reaches the sixth or seventh rib. These conditions are not absolutely characteristic of natural respiration, since it is possible to produce a similar state of the lungs by inflation.

The absence of air from the lungs does not prove still-birth, since a child can be born alive and live for hours without any indication that air has entered them.

The absence or presence of air in the lungs is shown by the **hydrostatic test**, which depends on whether they sink or float in distilled water at the ordinary temperature. They should be tested, in the first instance, intact, then each lung separately, and afterwards in small sections.

If they sink in these conditions, the inference is that respiration has not occurred, provided they do not sink through pathological causes. On the other hand, if they float, the inference is that air has entered by respiration or inflation, provided they do not float by reason of the presence of gases produced by putrefaction.

Pressure upon the lungs, not sufficient to destroy healthy

lung tissue, expels gases due to putrefaction ; but, in the absence of putrefaction, it does not drive out the air in the alveoli due to respiration or inflation. Therefore, if the lungs first float, and then, after such pressure, sink, putrefaction has occurred before or after respiration or inflation ; but if, after pressure, they continue to float, the air in the alveoli has entered through respiration or inflation.

If food is found in the stomach, the presumption is that the child was born alive, unless it can be proved that the child swallowed it during birth, or that it was put into the stomach after death—two very improbable events.

Atmospheric air in the stomach proves that the child was alive as late as during birth, if the process of artificial inflation can be excluded.

No value is attached to the condition of the bladder, whether empty or full.

The condition of the ductus venosus in a new-born child does not assist in determining live- or still-birth, since it is, most probably, always open at birth, whether the child is alive or dead, and it is not closed until the second or third day after live-birth.

The state of the ductus arteriosus and foramen ovale proves nothing with regard to live- and still-birth. They are usually open for a variable time after live-birth, but they have been found closed in stillborn children.

The state of the middle ear is of no value in determining live- or still-birth. The cavity is not formed, as a rule, till respiration has continued for some time, and it may not be filled with air until twenty-four hours after live-birth. Besides, the mucus has been found replaced by air in cases of still-birth.

An approximate estimate of how long a child has survived its birth may be based on the state of the umbilical

cord and other conditions. In a child born alive, the cord usually begins to wither and mummify within a few hours after birth, but these processes are never delayed beyond three days. As a rule, it falls off on the fifth day, leaving an ulcerated surface which cicatrizes on the eighth to the twelfth day after birth. In a still-born child the cord never spontaneously separates, although it may wither or decompose. The epidermis may begin to scale off on the first day, but generally not before the third day after birth, and it may continue to do so for a very variable period. If the alimentary canal is not obstructed, the meconium is almost always expelled before the second or third day, frequently at or even before birth.

CONCEALMENT OF THE BIRTH OF A CHILD

Every person who endeavours to conceal the birth of a child by a secret disposition of its dead body, whether it died before, at, or after its birth, is guilty of a misdemeanour, and liable to two years' imprisonment.

There is sufficient 'secret disposition' if the dead body is put where it is not likely to be found except by accident or search, although it is not concealed from anyone who may happen to go there.

Before a woman can be indicted for this offence, a dead body must be found and identified as that of the child of which she is alleged to have been delivered. To be **a child**, as far as this offence is concerned, it has been thought that the fœtus must have attained a viable age. But it has been held in one case that a fœtus not bigger than a man's finger, but having the shape of a child, is a child within the meaning of the statute. The secret disposition of a mole, or any other product of conception *not a child*, does not constitute an offence.

A person tried for the murder of a child and acquitted can be convicted of attempting to conceal its birth, if the facts are sufficient.

A medical examination may be required to determine whether the thing found is a child or not, or whether the alleged mother was recently delivered of a child or not.

PREGNANCY

A woman is pregnant from the time an ovum is impregnated until the foetus, alive or dead, is expelled. But the existence of a mole, or any other abnormal product of conception, does not appear to constitute pregnancy referred to in law.

Concealment of pregnancy is not an offence; but in Scotland it is a crime if the child is born dead or is amissing.

The question of the presence or absence of pregnancy arises when a woman asserts, after the death of her husband, that she is pregnant with an heir to his estate; or when she pleads pregnancy as a ground for increased damages either in a case of seduction or on the death of her husband, or in stay of execution of capital punishment.

In the last case the question is decided by the verdict of a jury of matrons, who are sworn to 'search and try the prisoner at the bar whether she be with child, of a quick child or no.' But medical assistance is now always required. In every other case the question is decided by medical examination.

No one can order an examination for pregnancy, and it is an indecent assault to examine a woman without her free consent. Therefore a practitioner should avoid examining a servant with regard to pregnancy, at the request

of her employer, unless he has obtained the servant's free consent and the presence of a reliable woman, and has explained to the employer that he cannot reveal the results of the examination without permission.

In this country the period of life during which pregnancy occurs corresponds to that of menstruation, from the fourteenth to the forty-fifth year. But pregnancy has occurred as early as the ninth and as late as the sixty-fourth year. Its usual duration is thirty-eight to forty weeks, and the earliest period at which it can occur after delivery is generally believed to be about a month.

The only **absolute proofs** of pregnancy are the foetal heart sounds and the shape of the foetus felt through the abdominal wall.

The **heart sounds** are seldom heard before the fifth month of gestation; often they are not heard at all even in late pregnancy.

The **form of the foetus** is rarely felt before the sixth month, and then only when the state of the abdominal wall, the liquor amnii, and other conditions are favourable.

With regard to the other signs of pregnancy, it is when they are taken together that they raise the presumption that pregnancy exists. Each of them, *e.g.*, cessation of menstruation, morning sickness, enlargement of the uterus and breasts, pigmentations, ballottement, uterine souffle, or abdominal movements, can be due to some other cause.

After death the question of pregnancy is decided by the presence or absence of an embryo or foetus, either intra or extra uterine. A mole, or any other abnormality resulting from conception, proves, of course, that pregnancy has existed.

Whether a corpus luteum is present or not cannot be

considered, since that of pregnancy, or the so-called *true*, cannot be absolutely distinguished from that of menstruation, or the so-called *false*, and a corpus luteum has been found when there was neither menstruation nor pregnancy.

DELIVERY

The question of the delivery of a child is most likely to arise in cases of infanticide, concealment of birth, abortion, and with regard to supposititious children.

A medical practitioner should note the time of the birth of a child if he is present at it, as his testimony may be important in the event of contested legitimacy, and with regard to proof of attainment of majority.

When a practitioner is called to a woman said to have been delivered of a child, he ought always to make an examination, and satisfy himself if possible whether she has been recently delivered or not, otherwise he may assist in perpetrating a fraud by means of a **supposititious child**.

If on examination a woman is found in the condition usually existing after delivery of a child at full term, namely, general weakness, discharge of blood from the vagina, rupture of the posterior commissure and perhaps of the perineum, swollen vulva, dilated vagina, patulous and fissured external os uteri, and flaccid abdominal wall through which the enlarged uterus can be felt above the pelvis, the presumption is that she has been recently delivered of a child; but this presumption can be rebutted by proving that a large pathological growth has been expelled from the uterus. If, in addition, fœtal membranes or placenta are found unexpelled, the proof of recent

delivery becomes absolute. The more advanced the period of pregnancy, the more marked are the signs of delivery. After early abortion they may be absent altogether.

Apart from the state of unconsciousness produced by anæsthetics, it is possible for a woman to be delivered unconsciously, either in a profound sleep or during efforts at defæcation.

An estimate of the length of time since delivery can be made for a short period only, and must be somewhat indefinite. After delivery at full term the conditions may so rapidly approach the normal that in a week the ordinary signs may have disappeared.

The milk usually appears within three days after delivery, and at first contains colostrum. The lochia begins with delivery, when it consists of liquid and coagulated blood. On the fourth or fifth day it is clearer, more liquid, brown in colour, and has a disagreeable odour. Towards the eighth day it becomes thicker, opaque, and greenish or whitish yellow. It varies considerably in quantity and duration, and frequently ceases before the third or fourth week.

If death follows immediately after delivery at full term, the uterus is found to be 9 to 12 inches in length. It contains blood-clots and remains of the decidua, and displays the placental surface, to which more or less of the placenta may be adherent. In one or two days after delivery the uterus measures in length about 7 inches, at the end of the first week about 5 to 6 inches, and in a fortnight about 5 inches. It usually contracts to its normal size in a month.

LIVE-BIRTH

At law, a child is not born alive until it is completely expelled from its mother, that is, altogether outside the vulva, and then shows some signs of life, such as crying, or breathing, or pulsation of the cord, or other indication of circulation, or movement of any part of the body, or emission of urine or meconium.

Neither division of the cord nor expulsion of the placenta is necessary to complete the birth of a child. But in Scotland respiration is an essential legal proof of live-birth.

A child's legal rights arise as soon as it is born alive, no matter what its uterine age may be, or how soon it may die.

Although it is possible for a child to be born alive as early as the fourth month of uterine life, and there are cases on record of children born in the sixth month who have lived for months and even years, yet they rarely attain to maturity if born before the seventh month.

By **Tenancy by Curtesy**, the husband on the death of his wife is entitled to a life interest in certain kinds of her undisposed-of real estate, provided a child is born, which must be the issue of the marriage, of the sex to which the estate can descend, and not a monster. It must be born alive and during the lifetime of the mother. If it is born alive after her death, either *per vaginam* or by Cæsarean section, tenancy by curtesy does not arise, although the child is legitimate.

‘**A monster** which hath not the shape of mankind cannot be heir or inherit any land, albeit if it be brought forth within marriage, but although he has deformity in

any part of his body, yet if he has human shape he may be heir.'

It is the external shape, but not mere deformities, nor the formation or shape of the internal organs, that determine a monster. Whether it is a monster or not is for the decision of the court. The duty of a medical witness is to describe it. No one is justified in killing a monster.

LEGITIMACY

At law, a child born during wedlock, or within the period of gestation after its termination, is presumed to be legitimate; the husband is presumed to be its father. Proof of conception before marriage does not make the child illegitimate. But this presumption can be rebutted by proof of non-access or impotency of the husband, or that the wife was notoriously living in adultery and apart from him at the time at which the child must have been begotten.

In Scotland, but not in England or Ireland, a child becomes legitimate on the marriage of its parents.

From legitimacy arise the rights of inheritance, of bearing the father's name, of kinship, and family ties, including those of maintenance, education, and protection; but with regard to **bastards**, the law recognises the natural tie between them and their parents, so far, at least, as to impose on the latter the support and maintenance of the former.

The question of legitimacy may arise with regard to succession to titles and estates, in the distribution of property in intestacy, in petitions for declaration of legitimacy under the Legitimacy Declaration Act, 1858, and in other cases.

The law does not definitely fix the period within which a

child must be born, to be legitimate, after the death or commencement of non-access of the husband. A child born forty-three weeks after an alleged intercourse has been declared legitimate, but an attempt to fix the paternity of a child by asserting gestation of forty-four weeks and three days' duration has failed.

As the **uterine age** of a child at birth may be important in cases involving disputed legitimacy, or paternity, or the possibility of live-birth, it is necessary to be familiar with the appearances of a foetus at different periods in uterine life.

At three to four weeks the length is about a quarter of an inch, and the weight about 20 grains; the shape is serpent-like, the mouth is represented by a cleft, the eyes by two dark spots, and the limbs by nipple-shaped projections.

At two months the length is 1 to 2 inches, and the weight about 2 drachms; the head is defined, the openings of the mouth and nose are separated, and the digestive canal is withdrawn into the abdomen.

At three months the length is 2 to 4 inches, and the weight about 1 ounce; the head is voluminous and separated from the trunk by the neck, the lips and eyelids are closed, the pupillary membranes are present, the umbilical cord is twisted and inserted into the lower fourth of the linea alba, the chest can be differentiated from the abdomen by the ribs, the anus is open, the fingers and toes are distinguishable, and the sex can be ascertained by the lens.

At four months the length is 4 to 6 inches, and the weight 2 to 4 ounces; nails and downy hairs are appearing, the mouth is open, and the sex can be distinguished on inspection.

At five months the length is 5 to 10 inches, and the weight $\frac{1}{2}$ to 1 pound; the skin is covered with vernix caseosa, hair is commencing to appear on the head, and the nails are distinct.

At six months the length is about 12 inches, and the weight 1 to 2 pounds; there is still adhesion of the eyelids, the pupillary membranes continue, the eyebrows and eyelashes are forming, and the scrotum is smooth and empty.

At seven months the length is about 14 inches, and the weight 2 to 4 pounds; the hair on the head is about a quarter of an inch long, the eyelids are not adherent, the pupillary membranes are disappearing, the nails do not reach the ends of the fingers and toes, and the testicles are still in the abdomen.

At eight months the length is about 16 inches, and the weight 4 to 5 pounds; the pupillary membranes have disappeared, the downy hair is becoming less, the nails extend to the ends of the fingers, and the testicles have descended into the inguinal canal.

At full term the length is 16 to 20 inches, and the weight averages $6\frac{1}{2}$ pounds; the vernix caseosa is abundant, the downy hair has almost disappeared, the hair on the head is about an inch long, the nails extend beyond the tips of the fingers and reach the tips of the toes, and the testicles are usually found in the scrotum.

SUPERFŒTATION

is the impregnation of an ovum in a woman already pregnant. Although its possibility cannot be absolutely denied, it is generally doubted except in cases of double uterus.

The question of its occurrence is liable to arise in disputed legitimacy or paternity. For example: a woman is delivered of a full-term child eight months after the death or absence of her husband, and two months later she is delivered of another full-term child. Is the second child legitimate?

Unequal development of a twin conception, or the existence of a double uterus, can account for this case and most of the alleged cases of superfœtation.

The possibility of **superfecundation**, or the separate impregnation of more than one ovum of the same ovulation, is admitted.

HERMAPHRODITISM AND SEX

A *true* hermaphrodite has the genital organs of both sexes—one or both testicles with one or both ovaries. The power of self-production does not appear to have ever existed. A true hermaphrodite cannot marry.

But the description 'hermaphrodite' is usually applied to a person who has the genital organs of one sex with the external genital appearance of the other—a *false* hermaphrodite. It would apply to a male with undescended testicles, divided scrotum, and small hypospadic penis; or to a female with occluded vagina, large labia majora, and penis-like clitoris. The mistake most frequently made in distinguishing the sexes is to treat as a female a new-born male with divided scrotum and undescended testicles.

The question of sex is most likely to arise with regard to identity, marriage, impotency, rape, succession to titles and estates, and other legal rights and relations.

A person succeeds as heir according to the sex which prevails. If this cannot be determined by an examination of the genital organs alone, the general state and condition of the body may be taken into consideration—the form and proportion of the different parts, the voice, growth of hair, and, to a less reliable extent, the mental habits and tendencies.

IMPOTENCY AND STERILITY

Impotency is the inability to have sexual intercourse. **Sterility** is the want of power to impregnate or conceive.

The question of the existence of one or both of these conditions may arise in connection with disputed paternity or maternity. Impotency may be advanced as a plea by a person accused of rape; but, as elsewhere stated, to commit this crime connection beyond the vulva is not necessary.

Complete or even partial impotency alone, but not sterility alone, at the time of marriage, is sufficient cause for a **divorce**; but it must be permanent, or of such a nature that an operation to cure it would be attended with great danger to life. The validity of a marriage can be questioned on this ground by the husband or wife only and during the lifetime of both. An impotent party cannot sue on the ground of his or her own impotency. If the case is *boná fide*, no special period of cohabitation is required.

The court may direct that a medical inspection and report be made: with regard to the husband, whether he is capable of performing the act of coition, and, if incapable,

whether his incapacity is remediable or not ; and with regard to the wife, whether she is a virgin, and capable of coition or not.

Marriage of a male under fourteen years, or of a female under twelve years, is voidable ; but under seven years in both sexes it is void. The law does not presume impotency or sterility by reason of old age.

In the male, impotency is due to defective or abnormal formation of the penis, or defective power of erection, preventing its entrance into the vagina. Sterility is due to any cause, local or general, which makes the formation or emission of semen impossible, and probably always exists beyond three or four weeks after the removal of both testicles. Cryptorchids need not be either impotent or sterile.

In the female, impotency is caused by any state, physical or mental, that prevents connection ; but, unlike the male, general diseases, or paralysis, do not produce impotency, since connection can take place if she is entirely passive. Sterility is due to any condition that makes the formation or impregnation of ova an impossibility.

HANGING

Death by hanging, that is, by suspending the body by means of a ligature round the neck, is most frequently due to asphyxia. In complete suspension asphyxia begins almost at once, and is caused by the ligature occluding the air-passage. But apoplexy may be, to some extent, the cause of death if the great vessels in the neck are pressed upon ; and when it is the chief cause, death is not as soon as when it is principally due to asphyxia.

If the 'drop' is long, and a rotatory movement is given to the body, as in judicial hanging, there is most probably dislocation or fracture of the spinal column at the level of the second or third cervical vertebra, producing pressure on the spinal cord. In this case death occurs much earlier than when pressure is confined to the air-passage and vessels.

Complete suspension is not necessary for a fatal result, since death may follow when only the upper part of the body is lifted off the ground. As unconsciousness and loss of co-ordination come on early, there may be few or no efforts at self-rescue, although the limbs are quite free. The heart may continue to beat for twenty minutes after complete suspension.

The most frequent post-mortem appearances are general signs of asphyxia, with patches of ecchymosis on several parts of the body; a mark of the cord on the neck, with, perhaps, injuries to the hyoid bone, thyroid cartilage, and the adjoining tissues; dislocation or fracture of the upper cervical vertebræ, with injury to the spinal cord, especially in judicial hanging; protruded tongue; saliva on the chin; clenched hands; erected penis; and expelled urine and fæces. These, taken together, raise a strong presumption of death by hanging.

The mark of the cord is almost always at the upper part of the neck, above the thyroid cartilage, and oblique from before backwards and upwards. It is pale and soft if the ligature is broad, soft and yielding; but dark, through ecchymosis, hard and depressed, if the ligature is narrow and firm, especially if suspension has been continued for some time. If the ligature is very broad and elastic, or is separated from the skin, ecchymosis may be absent, or there may be no mark at all.

Marks on the neck may be due to the suspension of the body post-mortem to conceal the true cause of death. If they are produced shortly after death, they resemble those formed during life, and it is impossible to distinguish them. But if they are post-mortem the signs of asphyxia and other vital processes are absent unless they have been produced by some other cause during life.

In children and fat persons the neck may present marks like those in hanging, but really due to folds in the skin or to pressure by a shirt-collar or other article of dress.

The presence of saliva on the chin suggests, but does not prove, suspension during life.

The examiner should observe and note, not only the condition of the body with regard to its appearances and injuries, but also its position, surroundings, and extent of suspension, the kind of knot used in fixing the ligature, and every other detail likely to assist in determining whether it was suicidal, homicidal, or accidental hanging.

Excluding judicial hanging, most cases are suicidal, either as an initial act or, in some instances, after an attempt at suicide by some other means. Hanging is, in fact, the most frequent form of suicide. It is rarely accidental or homicidal, the latter meeting with considerable difficulty in an adult who is fully conscious and capable of offering resistance. When it is homicidal, one would expect to find marks of violence on the victim.

Judicial hanging chiefly concerns the prison surgeon. It is the only punishment that can be awarded in treason and murder, and it becomes murder if the execution is not carried out in strict conformity with the sentence by

the proper officer. As the sentence is that the criminal be hanged by the neck till he is dead, if he survives, he must be hanged again.

STRANGULATION

In strangulation death is caused principally by asphyxia produced by pressure on the air-passage in the neck, without suspension of the body, either by a ligature or by the hand. The process is described as **throttling** if pressure is applied by the hand.

The post-mortem appearances are those of asphyxia and injuries to the neck. Ecchymoses occur in the conjunctivæ, face, and upper parts of the body, and the general condition may resemble that in hanging. As in hanging, the mark on the neck varies in character according to the nature of the ligature, but it is usually more circular and at a lower level. It may be altogether absent. In throttling, the marks may correspond to the number, position, and shape of the fingers. Marks can be produced on the neck immediately after death similar to those produced during life, but neither asphyxia nor any other indication of strangulation is present.

Almost all cases of strangulation are homicidal, and it is a frequent form of infanticide. It can be accidental, and, by means of a ligature, even suicidal. Throttling is perhaps always homicidal. An attempt to commit suicide by this method would most probably fail through relaxation of the grip as unconsciousness comes on.

DROWNING

is caused by water entering the air-passages, preventing respiration, and thus producing asphyxia, which begins immediately after submersion of the mouth and nose, even in a small quantity of water. Recovery seldom, if ever, takes place after five minutes' complete submersion, unless syncope has suspended respiration.

As a rule, the human body, when alive, tends to sink in water; but well-developed, new-born children usually float. The tendency to sink is increased when water enters the lungs and stomach. A drowned body that has sunk rises again to the surface after a time, varying according to the season of the year, through the development of gases by putrefaction. When these escape it again sinks, and thus floats and sinks for some time.

If a dead body is taken out of water, it is necessary to avoid the immediate conclusion that death was caused by drowning. The body may have been thrown in after homicide; or death may have been due to injuries received while falling in, or may have occurred on dry land, the water afterwards covering the body; or fatal syncope may have preceded submersion.

On examination within a few hours after death, the following conditions may be found, in addition to the general appearances of asphyxia: coldness and pallor of the skin, which may present red patches and the appearance known as 'goose-skin'; retraction of the penis, scrotum, and nipples; substances grasped in the hands, or sand and mud under the finger-nails; fine frothy mucus at the nostrils, mouth, and in the air-passages,

which also contain water; subpleural ecchymoses and increased volume of the lungs, which protrude when the chest cavity is opened; and water in the stomach and middle ear. The fine frothy mucus is considered characteristic. It is due to attempts at respiration under water, and is never produced by putrefaction. The signs of drowning become less marked as putrefaction proceeds, and finally disappear.

The water found in the air-passages and stomach is probably the same as that in which drowning occurred. It may, however, have entered at another place after death, or been swallowed before immersion.

Wounds and other injuries on the body may have been suicidal or homicidal, or received while falling in, or after drowning. If they have been the cause of death before immersion, the signs of asphyxia and the fine frothy mucus in the air-passages are absent.

There are the same difficulties here as in other cases, as to whether the injuries were suicidal or otherwise, or were received before or after death. Drowning is most frequently unintentional, but it is often suicidal, chiefly among females; indeed, it is their usual method of suicide. It is one of the forms of infanticide, but is very rarely homicidal in adults, on account of the resistance likely to be met with. The absence of violence does not necessarily exclude homicide, as the deceased may have been taken by surprise and unable to attempt to save himself by offering resistance. Nor does the presence of injuries indicate homicide, because they may have been inflicted in attempts at suicide completed by drowning, or, as already stated, they may have been received at the time of immersion or afterwards. If the body is found weighted and tied, it is probably a case of suicide,

as this is liable to be done to prevent self-rescue. But it must be homicidal if the weighting and tying is of such a nature that the deceased could not have effected them himself, or been able by his own efforts to throw himself into the water.

The state of a drowned body when taken out of water, in which it has been since drowning occurred, may assist in forming an opinion of the probable length of time since death. The following is taken from observations made in Paris during a severe winter. In summer the changes take place four or five times more quickly than in winter.

On the third or fourth day there is rigor mortis and bleaching of the skin, particularly that of the hands.

At the end of the first week the body is flaccid, and the skin of the palms of the hands is very white.

At the end of the second week the face is slightly bloated and covered with red patches, the skin over the middle of the sternum has a greenish tint, and that of the hands and feet is wrinkled.

At the end of the first month the green patch over the sternum is more extensive, the eyelids and lips are also green, and the scrotum and penis are distended with gas.

At the end of the second month the face is brown and considerably swollen, much of the skin of the hands and feet is removed, but the nails are adherent, and the hair is becoming loose.

At two months and a half the nails of the fingers, but not of the toes, are detached, and saponification is commencing, especially in females.

At three months and a half the nails of the toes are detached, saponification is more or less extensive, and

the skin and subcutaneous tissues in many parts are destroyed.

Putrefaction in a body is less active in water than in air, but it advances rapidly after removal from water. Therefore a dead body should be examined as soon as it is taken out, if an attempt is made to estimate how long it has been in.

SUFFOCATION

Death by suffocation is due to asphyxia produced by obstruction of respiration by any means except hanging, strangulation, or drowning.

The most usual methods are by **smothering**—the mouth and nostrils being closed, or covered or stuffed with foreign bodies; by **choking**—the air-passage beyond the mouth and nose being obstructed by something in or pressing upon it, or by sudden œdema due to hot water or some other cause; by pressure on the chest; and by inhaling such gases as carbonic oxide and sulphuretted hydrogen. The effects of gases, however, are usually regarded and described as poisoning.

Suffocation is usually accidental. When it is homicidal, it is most frequently in children, but sometimes in adults when they are unconscious or unable to resist. It is the most frequent form of infanticide. In **overlaying** the real cause of death is usually suffocation, through the child's face becoming accidentally covered with the bedclothes or pressed against the nurse's breast; or through breathing the vitiated air under the bedclothes. Suicidal smothering by stuffing pieces of cloth or other things into the mouth and nostrils has occurred among the insane.

No one has ever succeeded in committing suicide by holding his breath.

The general post-mortem appearances are those of asphyxia. There may be punctiform ecchymoses and emphysema of the lungs, particularly in children. Foreign bodies or pathological conditions in the air-passage, or pressing upon it, may be found ; and, as already remarked, these ought always to be looked for, especially if a sufficient cause of death cannot be found elsewhere. The effects of pressure on the body may be seen in the form of fractured ribs or sternum, or injured viscera.

STARVATION

is the condition caused by total deprivation or insufficient supply of food.

A person is guilty of homicide if he neglects to supply the necessities of life, food, and medicine to one for whose care he is responsible, and who dies as the result of such neglect. A person over the age of sixteen years, who has charge of a child under sixteen years, is guilty of a misdemeanour if he wilfully neglects such child in a manner likely to cause it unnecessary suffering or injury to health.

Starvation may be unavoidable, as in obstruction in the œsophagus ; or suicidal, when it is chiefly among the insane and criminals ; or homicidal, of which there have been many cases, especially in children and weak-minded persons.

A strong, healthy man would probably die in twelve to fourteen days after total deprivation of food. A man supplied with water only is reported to have lived sixty-four days.

When every kind of nourishment is cut off, the symptoms of starvation very soon arise in the form of thirst, feeling

of hunger, which is lost in two or three days, and abdominal pain, particularly on the second day. This condition is accompanied and succeeded by increasing weakness; general emaciation supervenes, and the bones become prominent. The bowels are constipated, or hard fæces may be passed; the breath becomes fœtid and hot, but the temperature is usually subnormal. Finally, delirium and convulsions may precede death, which occurs before, or as soon as, the body loses two-fifths of its weight. This loss proceeds at the rate of about one-twenty-fourth of the weight of the body per day.

The appearances after death, especially in those who have lived for some time on an insufficient supply of food—**chronic starvation**—are general emaciation, absence of fat, and the condition aptly described as ‘skin and bone.’ The intestines may contain gas and fæces, but they are usually empty and collapsed, their walls being thin and transparent. The gall-bladder is distended with bile, all the other organs are diminished in size and weight, and a general state of bloodlessness is conspicuous. Putrefaction is rapid.

All general wasting diseases, such as phthisis, diabetes, and cancer, must be excluded before the cause of death is ascribed to starvation only.

BURNS AND SCALDS

An injury to the body by a heated or corrosive substance is a **burn**; but it is usually termed a **scald** when it is produced by a heated liquid or vapour. It is almost certain to be fatal if it involves a third of the surface of the body.

When a person is burned to death, as in a house on fire, he may be dead or unconscious through shock or carbonic oxide poisoning before the heat acts directly on his body.

If a burn is not immediately fatal, death may occur through resulting gangrene, or pyæmia, or meningitis, or disease of the lungs or other organs, or ulceration and perforation of the bowels, particularly the duodenum. In children, fatal œdema of the glottis is apt to occur through drinking from the spout of a kettle of hot water or tea.

The appearances due to the effects of heat are congestion, blisters, and charring. If a burn shows any sign of vital action, such as granulation or pus, it must have occurred during life. **Blisters** due to heat immediately before and after death are not distinguishable from each other, since they can have the same characters. They contain serum with a considerable amount of albumin; their bases are congested, and they are surrounded by a bright red line. If they are produced by heat, a few hours after death, their bases are not congested, they are not surrounded by a red line, and they contain air only; but in dropsical subjects they contain thin serum with very little albumin.

SPONTANEOUS COMBUSTION

Combustion of the human body never occurs without ignition. But **ignition** can be facilitated by excessive deposit of fat and fatty degeneration of the organs, a condition liable to follow prolonged consumption of alcoholic liquors.

A large quantity of gas in the abdomen, and accumulation of carbonic oxide in the tissues, are credited with assisting combustion. The gas is easily ignited, and starts the melting and burning of the fat.

HEAT

Death probably always occurs when the temperature of the body reaches 11° F. above normal.

Heat-stroke is produced by overheated air, and is fatal through congestion of the brain, a condition described as 'heat-apoplexy.'

The symptoms and post-mortem appearances are similar to those in sunstroke.

SUNSTROKE

is due to direct exposure to the rays of the sun.

The usual symptoms, indicating injury to the nervous system, with derangement of the heat-regulating centres, are vertigo, headache, sometimes mental excitement in the early stage, increased temperature, feeble pulse, difficult or sighing respiration, paralysis, and finally coma.

Post-mortem, the viscera are generally found to be hyperæmic, and the brain may be œdematous. Rigor mortis is intense, appearing and disappearing speedily; and putrefaction begins early and advances rapidly.

In cases of death under circumstances in which heat-stroke or sunstroke can occur, the examiner should bear in mind the probability of one of these conditions being the cause of death.

LIGHTNING

can kill instantly by shock to the nervous system without leaving any indication of injury. If the patient survives the immediate effect of the shock, the symptoms may resemble those of compression of the brain, or some other form of damage to the central nervous system. In slight cases the temporary symptoms consist of pains in different parts of the body, headache, and mental confusion.

The injuries caused by lightning are very varied. There may be burns, ecchymoses, fractures, or other forms of

injury similar to those produced by violence other than lightning; the clothes may be more or less burnt, and they have been so completely torn and removed as to leave the body quite naked. The peculiar arborescent markings sometimes found on the surface of the body are due to the paths of the discharge causing a form of erythema.

It is possible to erroneously assign death to lightning when it was really due to some other form of violence. On the other hand, the post-mortem appearances in death by lightning may suggest homicide; but this may be rebutted by the position of the body together with the history and signs of a recent thunderstorm, and the burnt condition of the clothes, or the fusion of metallic articles on the person.

After death by lightning rigor mortis sometimes comes on and passes off rapidly, the viscera are usually congested, and putrefaction occurs early.

Fatal results have followed contact with **electric wires** or cables. The injurious effects of an electric current depend on its tension and duration. It would probably be dangerous if its pressure amounted to 500 volts. Death is due to cardiac or respiratory paralysis, or both. In cases that recover the symptoms may be those of shock, as in lightning. Injuries have been found on the body at the point of contact, and, in fatal cases, the internal appearances may be similar to those after death by lightning.

COLD

It is stated as a general law that a warm-blooded animal must die when it is kept in a cold so intense that its temperature sinks 18° to 27° F. below normal for any length of time.

When cold is sufficiently severe and long continued, the body temperature is lowered, and the giving up of oxygen to the tissues by hæmoglobin is impeded. Consequently, nervous and general depression and death are liable to ensue, especially in the old and young, the diseased and infirm, in drunkards, and after fatigue or want of food.

The effects of cold begin with a feeling of stiffness and loss of muscular power, followed by a tendency to lie down. The supervening drowsiness passes into coma.

After death the exposed skin may be cherry-red through the hæmoglobin absorbing and retaining oxygen in the cold, a condition distinguishable from ordinary post-mortem stains by being in non-dependent parts, and therefore not due to gravitation, and from the stains in carbonic oxide poisoning, by the absence of this gas. As a rule, the brain and its membranes, but, sometimes, the abdominal viscera also, are found congested.

Intentional death by exposure to cold is rare. When it occurs it is usually homicidal, and the victim is an infant. Drunkards and other persons are often found dead under circumstances suggesting violence, whereas the real cause of death is exposure to a low temperature.

Frost-bites are frozen parts of the living body, most frequently the ears, nose, fingers, and toes. At first the condition is that of erythema followed by formation of blisters filled with reddish serum which becomes purulent. Exposure to cold after death cannot have this effect.

INSANITY

It is impossible to give a definition of insanity at once concise and sufficiently comprehensive. For medico-legal purposes, it is sufficient to define it as the state of the mind in which there is absence or disturbance of its faculties to

such an extent that the individual is not responsible for his acts, or is incapable of managing himself and his affairs.

Insanity does not include temporary mental disturbances due to a specific fever or the effects of drugs or poisons, nor intellectual dulness by reason of defective education, nor eccentricity.

The question of insanity comes under the consideration of the general practitioner, chiefly with regard to criminal responsibility, civil capacity, and in certifying, when removal and restraint are necessary, in cases of insanity among private or pauper patients, or in lunatics wandering at large.

The law presumes that every man is, *primâ facie*, sane, and, when insanity has existed, that it continues until it is shown to have ceased.

If a person commits a crime the presumption is that he was sane at the time, and therefore responsible for it. But this presumption can be rebutted by proving that he, by some mental disease, was unable to understand the nature and quality of the act he was doing, or, if he did understand it, he did not know he was doing wrong.

Insanity, occurring after the commission of a crime, is a bar to criminal proceedings at any stage—arraignment, trial, judgment, or execution.

A person with an insane delusion connected with the offence he has committed is put in the same position, as to responsibility, as if the delusion were a real fact. Take a couple of illustrations from Stephen's 'Digest of the Criminal Law': A is not liable to punishment if he meets B, and, under a delusion that B is about to take away A's life, he kills B in self-defence. But he is liable if he

meets B, and, under the delusion that B has slandered him, he kills B on that account.

If a lunatic enters into a contract, he is bound by it, unless it can be shown that, at the time of making it, he was wholly incapable of understanding what he was doing, and that the other party knew of his condition.

With regard to the marriage contract: In a petition to declare a marriage void, on the ground of insanity, 'the court has to determine whether the respondent was capable of understanding the nature of the contract, and the duties and responsibilities which it creates, and was free from the influence of morbid delusions upon the subject.'

Insanity does not necessarily make a will void. A person can execute a valid will if at the time his mind can take in the nature and extent of his property and the persons who have claims on his bounty, and if his determination of the relative strength of their claims is free from external influence and from delusions.

The testimony of a lunatic is received in a court of law, if it is consistent and intelligent, if he is free from any delusion connected with the subject in question, and if he shows clearly that he knows the nature and consequences of an oath.

The law divides insanity into idiocy and lunacy. The term *non compos mentis* or unsoundness of mind, is used either as synonymous with insanity or to indicate a lesser degree of mental disturbance than insanity.

The reception and care of idiots and imbeciles are provided for by the Idiots Act, 1886. They can be placed in any hospital, institution, or licensed house registered under the Act by their parents or guardians, who make

the prescribed statements and obtain the following medical certificate :

I, the undersigned A B, a person registered under the Medical Act, 1858, and in the actual practice of the medical profession, certify that I have carefully examined C D, an infant [or of full age], now residing at —, and that I am of opinion that the said C D is an idiot [or has been imbecile from birth, or for — years past, or from an early age], and is capable of receiving benefit from [the institution (describing it)], registered under the Idiots Act, 1886.

Signed _____

(Full postal address.)

Dated _____

The procedure for **the removal and detention of lunatics** in England is regulated by the Lunacy Acts, 1890 and 1891.

When the patient is neither a pauper nor wandering at large : A petition and statement of particulars by the husband or wife or relative of the patient, if possible, is presented to a judicial authority, that is, a justice of the peace specially appointed for the purpose, or a stipendiary magistrate, or a Metropolitan police magistrate, or a county court judge. This is accompanied by two certificates of insanity by two qualified medical practitioners, in actual practice at the time, who have personally examined the patient separately and apart from each other, not more than seven clear days before the date of the presentation of the petition. If then the judicial authority is satisfied that the patient is insane, a reception order is made by him, by force of which the lunatic can be removed and detained in an asylum or licensed house.

In case of urgency : A lunatic, for his own safety and that of the public, can be received and detained on an urgency order and statement of particulars made by a husband or wife or relative, if possible, together with one

medical certificate of insanity. For this certificate the medical examination of the lunatic must be made not more than two clear days before his reception. An urgency order remains in force seven days from its date.

When the lunatic is a pauper or wandering at large, the reception order can be made by a justice of the peace (not necessarily a judicial authority), before whom the alleged lunatic is brought, after obtaining one medical certificate of insanity. The medical examination must be made not more than seven clear days before the date of the order. For the public and his own safety, a lunatic wandering at large can be removed to the work-house and placed under control before the necessary proceedings are taken; but he cannot be detained there longer than three days.

If the removal of a lunatic is suspended by a medical certificate that he is not fit to be removed, he may be received within three days after the date of a medical certificate of his fitness for removal.

The following is the medical certificate:

In the matter of A B, of — in the county of —, an alleged lunatic.

I the undersigned C D, do hereby certify as follows:—

I am a person registered under the Medical Act, 1858, and I am in the actual practice of the medical profession.

On the — day of — 19—, at — in the county of — (separately from any other practitioner), I personally examined the said A B, and came to the conclusion that he is a (lunatic, or idiot, or a person of unsound mind), and a proper person to be taken charge of and detained under care and treatment.

I formed this conclusion on the following grounds, viz.:—

Facts indicating insanity observed by myself at the time of examination, viz.: _____

Facts communicated by others, viz.: _____

[In case of urgency, insert here: I certify that it is expedient for the welfare of the said — (or for the public safety, as the case

may be) that the said —— should be forthwith placed under care and treatment.

My reasons for this conclusion are as follows :]

The said A B appeared to me to be (or not to be) in a fit condition of bodily health to be removed to an asylum, hospital, or licensed house.

I give this certificate having first read the section of the Act of Parliament printed below.

Signed _____
(Insert full postal address.)

Dated _____

Extract from Section 317 of the Lunacy Act, 1890 :

Any person who makes a wilful misstatement of any material fact in any medical or other certificate, or in any statement or report of bodily or mental condition under this Act, shall be guilty of a misdemeanour.

This certificate must not be signed by the petitioner ; or the person signing the urgency order ; or the manager or any regular attendant of the institution in which the lunatic is to be received ; or the person to have charge of him as a single patient ; or a person interested in the payments on his account ; or the husband, wife, father or father-in-law, mother or mother-in-law, son or son-in-law, daughter or daughter-in-law, brother or brother-in-law, sister or sister-in-law, or the partner or assistant of any of these persons ; or a member of the managing committee, or a commissioner, if the lunatic is to be taken to a hospital ; or by a commissioner or ' visitor ' when not authorized, if the lunatic is to be taken to a licensed house.

The certificate must be filled up correctly. Some errors can be remedied, such as omission of the occupation, or defective description of the residence of the patient or the person from whom statements have been received. But a certificate is vitiated, and a reception order

cannot be made on the strength of it, if the words 'I am a person registered under the Medical Act, 1858, and I am in the actual practice of the medical profession,' or, when two certificates are necessary, the words 'separately from any other practitioner,' are struck out; or if the date of the examination, or the facts indicating insanity observed by the certifier at the time of the examination, are omitted.

The facts indicating insanity should be stated as fully and clearly as to make further explanation unnecessary, and to satisfy a court of law. By the section quoted at the foot of the certificate, a wilful misstatement of any material fact in the certificate is a misdemeanour.

A medical practitioner need not examine and certify to the mental state of any person unless it is a condition in his appointment or office that he should do so. But if he undertakes the duty he must do it with the greatest care. The court can stay legal proceedings against the certifier if it is satisfied that he acted in good faith and with reasonable care.

It is necessary to remember that every insane person need not be removed and detained in an asylum, hospital, or licensed house. The medical certificate requires that the patient is 'a proper person to be taken charge of and detained under care and treatment.'

In Ireland the procedure for the removal and detention of lunatics is much the same as above described. Two medical certificates are required for a private patient, one for a pauper. It is not necessary to state in the certificate the facts indicating insanity.

In Scotland two medical certificates are required for a private or a pauper patient, and these certificates, together with a petition, must be presented to the Sheriff.

In the case of a Chancery lunatic—that is, a lunatic placed under the care of the Lord Chancellor, after an inquisition or inquiry, an order for the detention of the lunatic in an asylum, hospital, or licensed house can be made by the committee having charge of him, or, if no committee has been appointed, by a Master in Lunacy.

In **idiocy** the development of the mental faculties is either altogether wanting or it has been imperfect. The former condition is known as *amentia*, the latter as *imbecility*, a term applied to all grades of idiocy between *amentia* and sanity.

Lunacy embraces all forms of mental disease occurring in those who have been sane, the principal varieties being mania, melancholia, and dementia.

In *mania* there is general disturbance of the mental faculties and loss of self-control to a variable extent, with excitement and restlessness. Reasoning continues, but it is on false premises, and beyond control. Ideas are without order and connection.

In *acute delirious mania* there is delirium with hallucinations, excitement, restlessness, sleeplessness, and constitutional disturbance with increased temperature.

In *ordinary acute mania* the disturbance is more mental than in the acute delirious form. There may be absence of delirium and rise of temperature. It begins with restlessness, disturbed sleep, and irritability. Afterwards there may be illusions, hallucinations and delusions; movements become incessant, and speech more incoherent.

Chronic mania may follow the acute form or precede dementia. Its chief symptoms are defective memory, judgment, and self-control, with restlessness, and, sometimes, delusions and hallucinations.

In *melancholia* the mental state is chiefly characterized by gloom and depression, which is out of all proportion to the ascribed cause, and by excessive self-consciousness. Delusions are frequent; but, apart from them, the patient can talk and argue rationally on most subjects with which he has been familiar. Suicidal tendencies are extremely common.

In *dementia* the power of reasoning is diminished or lost. Ideas become few or wanting altogether. In this respect it differs from mania, in which the ideas may be exuberant, and from melancholia, in which they may be abundant, but clouded with gloom and misery.

The terms *delusional insanity*, *monomania*, and *partial insanity*, are applied to the mental condition in which there is a fixed and limited delusion, with few or no signs of derangement apart from the acts or speech depending on the delusion.

Moral insanity is characterized by perversion of the moral sense without any other evident disturbance or affection of the mental capacity. Between this and moral depravity there is no fixed boundary.

In *impulsive insanity* the principal feature is a strong and uncontrollable impulse to do some irrational act. There are no delusions.

Although delusions, illusions, and hallucinations are usually associated with insanity, it can exist without them.

An insane **delusion** is a deception of the mind, a persistent belief that things existing only in the patient's imagination are real, and he cannot be reasoned out of it. It is of such a character that no rational person can believe him capable of holding it if he were sane. For example, an inmate of a workhouse persistently believes he is President of the United States.

An **illusion** is an erroneous impression on the mind produced by an external cause, as when a person sees an object which he believes to be something else.

In **hallucinations** there are erroneous sense impressions without any external cause, as when a person believes he hears voices when there is absolute silence.

Illusions and hallucinations are apt to occur in the sane; but here they are corrected by the other senses, and are not acted on.

Suicide is not a proof of insanity. As already stated, at law it is a felony, and the attempt is a misdemeanour.

A **lucid interval** is a temporary intermission or cessation of insanity, during which a person is responsible for his acts and capable of managing himself and his affairs.

It is very difficult to feign insanity. Indeed, it can be done successfully only by those who are familiar with the characteristic features of its different forms. But many insane persons can feign sanity by concealing the delusions that are the only proof of their insane condition.

DRUNKENNESS

A person is liable, on summary conviction, to fine or imprisonment if he is found drunk in any street or public thoroughfare, building, or other place, or on any licensed premises; or if, while drunk, he is guilty of riotous or disorderly behaviour, or is in charge of any carriage, horse, cattle, or steam-engine, or is in possession of any loaded firearms.

Although voluntary drunkenness is no excuse for crime, it may be taken into consideration when motive or intention is an essential element.

A person is not criminally liable for his acts done during

involuntary drunkenness; but his liability is determined as in insanity, for acts done while in delirium tremens or any other form of mental disease due to voluntary drinking of alcoholic liquors.

A contract made by a person in a state of intoxication may be voided by him when he becomes sober; but if then he confirms it he is bound by it.

Ordinary cases of drunkenness do not present special diagnostic difficulties. But if a person is unconscious it may be impossible to state positively whether it is due to alcohol or some other poison, or to disease or injury. The diagnosis of the usual causes of unconsciousness and the care to be exercised, especially in police cases, are discussed with poisoning by alcohol.

Under the Habitual Drunkards Act, 1879, a habitual drunkard can be detained on his own application in a licensed 'retreat' for any term up to twelve months. His application must be in the form prescribed by the Act, and his signature must be attested by two justices of the peace who have satisfied themselves that he is a habitual drunkard, and have explained to him the nature of his application. It must be accompanied by the statutory declaration of two persons that he is a habitual drunkard within the meaning of the Act, that is, 'a person who, not being amenable to any jurisdiction in lunacy, is, notwithstanding, by reason of habitual intemperate drinking of intoxicating liquors at times dangerous to himself or herself or to others, or incapable of managing himself or herself, and his or her affairs.'

Under the Inebriates Act, 1898, a person who has committed a crime, punishable by imprisonment or penal servitude, under the influence of drink, or if drunkenness was a contributory cause, can be detained for a term not

exceeding three years in a State or certified inebriate reformatory, if he admits that he is, or is found by the jury to be, a habitual drunkard. A person convicted of drunkenness can be detained, for a term not exceeding three years, in a certified inebriate reformatory if he has been convicted summarily of drunkenness three times within the preceding twelve months.

LIFE INSURANCE

The usual form of life insurance is a contract by which the insurers, in consideration of annual payments called premiums, agree to pay a fixed sum of money, on the death of the insured, to his representatives. The written instrument containing the contract is known as **the policy**.

In the ordinary procedure in effecting a life insurance, the proposer makes a statement in writing, called **the declaration**, with regard to his present and past state of health, his family history, and such other particulars as the insurers may require. If, by design or ignorance, he conceals or states falsely any material fact, the policy is made void. When the insurers make the answers to their questions the basis of the policy, correct answers are essential. The proposer is liable to be asked if he has ever been afflicted with one or more of the diseases specially mentioned, or any other disease or habit which tends to shorten life. It is unnecessary to attempt to discuss the diseases and habits which have this tendency; but, it may be mentioned, they have been held to include alcoholic intemperance, insanity, opium-eating, and the habitual use of hydrate of chloral.

The proposer may refer the insurers to his usual medical attendant, who may be requested by them to examine the proposer or give them such information as they may ask for.

The medical attendant is not bound to examine or report, but if he undertakes the task he should do it as carefully and completely as the insurers require. He is usually given a printed form of questions which he should fill up accurately, as defective examination and erroneous statements may render the policy void. As referee, although he is not personally interested in the contract, he is liable to damages if he wilfully makes a false statement or colludes with the party making the proposal, and loss ensues.

An insurance is void from 'public policy' if the insured either commits suicide while sane (felonious suicide), or dies by the hands of justice or by duelling. But, with regard to felonious suicide, this rule applies only when the policy does not contain a contrary stipulation. The insurers may make the conditions include all cases of self-destruction, whether felonious or not.

The question of the cause of death is not conclusively settled by the verdict of a coroner's jury, as far as a life insurance policy is concerned. Therefore, if a medical witness, at the inquest on a person whose life has been insured, indulges in indefinite statements and vague opinions, he may afterwards have them picked to pieces in the witness-box in another court.

WILLS

As a medical practitioner is frequently consulted with regard to the testamentary capacity of his patient, and as he is liable to be called upon to witness the execution of wills, or even, in cases of great urgency, to write them, it is well that he should know something about the law with regard to them.

In the first place, by his will, a person makes a disposition

of his property to take effect after his decease, and can dispose of all property to which he is entitled at the time of his death. With regard to the question of what property passes by a will, it speaks and takes effect as if it had been executed immediately before the death of the testator, unless a contrary intention appears.

A **testator** must be twenty-one years of age, of sound mind, and capable of understanding what he is doing; he must have a knowledge of his property, of the way in which he wishes to dispose of it, and of the persons who have a claim on his bounty. Moreover, he must be able to express, by words or gestures, his wishes or his assent or dissent to any proposition with regard to the disposal of his property.

A will, to be valid, requires to be in writing (except in the case of soldiers on active service and sailors at sea), and properly executed.

If, through urgency, a medical attendant has to write his patient's will, the simple rule is to ascertain the extent and nature of the testator's property, to state as plainly and as fully as possible the manner and order in which he wishes to dispose of it, and to avoid ambiguity and the use of legal technical language. It is usual and proper to appoint one or more executors. The law does not require any particular form, provided the testator intends the instrument to take effect after his death.

To be validly executed, a will must be signed, at the foot or end of it, by the testator, or by some other person on his behalf, in his presence and by his direction, and such signature must be made or acknowledged by the testator in the presence of two or more witnesses present at the same time, who must subscribe their names as witnesses in the presence of the testator.

The following shows the **method of executing a will** :

In witness whereof I, the said [testator's name] have to this my will set my hand this — day of — 19—.

[Testator's signature.]

Signed and acknowledged by the above-named [testator's name] as his will, in the presence of us, present at the same time, who, in his presence and in the presence of each other, have hereunder subscribed our names as witnesses.

[Signatures and descriptions of witnesses.]

It is a sufficient signature if the testator makes a mark or writes his initials, or even a wrong name, since this would be taken as a mark. His hand may be guided, if, through illness, he requires this help; but tracing with a dry pen is not equivalent to a signature. No effect is given to anything that follows after the testator's signature, or is inserted after he has signed the will.

Witnesses in 'subscribing' their names need not write them underneath the will; it is enough if they are written upon it with the intention of attesting the testator's signature. A witness is not required to sign his name in full; his initials or his mark are sufficient. A person to whom, or to whose wife or husband, any benefit is given by the will, is a competent witness, but the gift is void. A creditor or executor may be a witness.

While the witnesses subscribe their names, the testator must be present and capable of recognising the act which is being performed before him. If he falls into a state of insensibility, temporary or permanent, after he has made or acknowledged his signature, but before the witnesses have subscribed their names, the attestation is insufficient. The execution of a will must be completed while the testator is alive.

A codicil is a testamentary instrument altering or

modifying a will, and must be executed in the same manner as a will. It is part of a will, and with it makes but one testament.

An alteration in a will after its execution must be executed as a will. It is sufficient if the signatures of the testator and witnesses are made in the margin or some other part of the will opposite or near the alteration, or at the foot or end of a memorandum referring to it.

A will is revoked by another will, or by subsequent marriage, or by destroying it—by burning, tearing, or otherwise—with the intention of revoking it. A revoked will cannot be revived except by re-execution or by a codicil showing the intention to revive it.

RELATIONSHIP OF DOCTOR AND PATIENT

does not prevent them entering into a **contract** with each other ; but in order to secure its validity it is advisable to have the intervention of a third party.

A medical attendant who receives from his patient a **voluntary gift** other than a trifling one is bound to show how the intention was produced in the mind of the donor, that the latter knew what he was doing, and that there was no undue influence. If this relationship has ceased and the donor intentionally elects to 'abide by his gift,' this would be a sufficient confirmation of it. 'At all events, after such a confirmation the legal personal representatives of the donor could not set it aside after his death.'

A **legatee** under the will of his patient is not bound to show how it came about that he was made a legatee, if the testator was free to act and understood what he was doing. But the preparation of a will in secret and its

execution without the testator having the assistance of his solicitor would be favourable circumstances for disputing its validity.

NEGLIGENCE AND MALAPRAXIS

A medical practitioner is not legally bound to attend to any person who may send for him, unless he has agreed to do so as a condition in an appointment or otherwise by contract. But, if he has begun the treatment of a patient, he ceases at his peril unless he is prevented continuing by a good reason.

The fact that he undertakes to treat a disease or perform an operation does not imply a guarantee to cure or to produce a successful result. He is, however, expected to take proper care and bring a reasonable degree of skill to the case. Therefore, if the treatment falls short of this, he is liable to damages for negligence or malapraxis, although his intentions may have been good, and the patient neither directly employed him nor was expected to pay. But he is not liable if the injury is directly due to the patient's own negligence or carelessness.

Negligence, to be criminal, must be so gross and culpable as to show an evil mind. It must be what the law considers 'felonious.'

DEFAMATION

A medical practitioner is, perhaps, specially liable to be defamed, on account of the nature of his work. Words are defamatory if they injure a person's reputation, or hold him up to hatred, contempt, or ridicule.

Defamation is **slander** if it is by words spoken or indicated by gesture ; or **libel** if by words written or printed, or by cartoon, or otherwise permanently recorded. To be actionable it must be published, that is, communicated to a third party. A libel may be a criminal offence.

In slander, special damage must be shown by the plaintiff except when the words charge him with the commission of a crime, or impute that he has a contagious disease which would cause him to be excluded from society, or tend to prejudice him in his calling ; or when they impute unchastity or adultery to any woman or girl. In these cases and in libel the words are actionable *per se*, that is, actionable without proof of any special damage. The damage must be, in a legal sense, the natural and probable result of the words complained of. Words apparently of a defamatory character are not actionable if they are within the limits of fair comment on subjects open to public discussion, and not published maliciously ; or if they are in fair reports ; or in a 'privileged' communication, that is, one made with the honest intention of discharging a legal, moral, or social duty.

It is a good defence that the words were true ; but in a criminal prosecution for libel it must be shown in defence that they were not only true, but were published for the public good.

REGISTRATION OF BIRTHS AND DEATHS

Live-births must be registered within forty-two days, and deaths within five days after their occurrence. Still-births are not registered. But for burial purposes

a medical practitioner can give a certificate of still-birth if he was present at the birth ; or, if not present, but if he has examined the child, he may give a certificate that in his opinion it was still-born.

If, through neglect or otherwise, a birth or death is not registered by the persons liable for registration, a medical practitioner who was present at the birth or death must appear personally at the registrar's office, after notice in writing, and give the necessary information.

CERTIFICATE OF THE CAUSE OF DEATH

This certificate, for the purposes of registration, can be given only by the registered medical practitioner who attended the deceased during his last illness. Only the *cause* of death is essential for this certificate, but the *fact* of death can be certified, in addition, if the certifier has examined the dead body.

A medical attendant cannot decline to certify to the cause of death because his bill has not been paid. It is a punishable offence to refuse, without proper reasons, to sign and give the certificate of the cause of death to the person required to register ; or to make a false certificate ; or to wilfully give a false answer or false information to the registrar ; or to refuse to answer questions lawfully put to him by the registrar.

In Scotland, a medical man attending during the last illness and until the death of any person, must, under a penalty of forty shillings, within seven days after such death, transmit to the registrar a certificate of such death in a special form.

NOTIFICATION OF INFECTIOUS DISEASES

In England and Scotland, but in Ireland only where the Infectious Diseases Notification Act, 1889, has been adopted, a medical practitioner is liable to a fine of forty shillings if he neglects to notify every case occurring in his practice, as soon as he is aware that it is one of the diseases known as small-pox, cholera, diphtheria, membranous croup, erysipelas, scarlatina, scarlet fever, typhus, typhoid, enteric, relapsing, continued, or puerperal fever, or one of the diseases added to this list by the Local Government Board or by the local sanitary authority with the sanction of the Local Government Board. Notification is to the medical officer of health of the district. Each case must be notified separately, and, according to the Act, by each practitioner called in to attend it.

POISONS

GENERAL REMARKS

IN this section are described, as briefly as possible, the most important of the substances usually regarded as poisons, *e.g.*, strychnine, sulphuric acid, and carbonic oxide, which destroy life by physiological or chemical action; but not those things that can kill by mechanical irritation or obstruction, *e.g.*, ground glass and solid bodies; nor the virus of any disease.

No poison is so virulent that it cannot be given in harmless doses—even the most powerful can be used medicinally; nor is there in any poison an absolute limit between a fatal and a non-fatal dose.

The toxic effects of a poison are varied in each individual by age, health, state of the stomach, idiosyncrasy, habit, mode of administration, and other conditions which differ in their influence on the action of each poison.

To unlawfully and maliciously administer or cause to be administered to any other person any poison or other destructive thing, or to attempt to do so with intent to commit murder, is a felony punishable by penal servitude for life.

To unlawfully and maliciously administer or cause to be administered to any other person any poison or other destructive or noxious thing, with intent to endanger life or inflict any grievous bodily harm, is a felony punishable by penal servitude for ten years. When the intent is to

injure, aggrieve, or annoy, the crime is a misdemeanour, for which the punishment is imprisonment up to five years.

If the substance is a recognised poison, it is no defence that the quantity administered did not amount to a poisonous dose; but to be a 'noxious thing' it must be noxious in the quantity used. Anything can be a 'noxious thing' if given to such an extent as to produce a noxious effect.

It is a felony, punishable by penal servitude for life, to unlawfully and maliciously apply or administer to, or cause to be taken by, any person any chloroform, laudanum, or other stupefying or overpowering drug, matter, or thing, or to attempt to do so, with intent to enable any indictable offence to be committed; or to throw at or upon, or apply to, any person any corrosive fluid, or any destructive or explosive substance, with intent to burn, maim, disfigure or disable, or do some grievous bodily harm to any person, whether any bodily injury is caused or not.

The **sale of poisons** is to some extent regulated by law. The substances mentioned in the schedules to the Pharmacy Act, or added by Orders in Council, can be sold only by persons registered under this Act, who, at the sale, must observe the prescribed rules as to knowledge of the purchaser, labelling, entries, and other details. Arsenic sold in quantities less than ten pounds must be mixed with a tenth to a sixteenth of its weight of soot or indigo.

A medical practitioner attending a patient suffering from arsenical, lead, or phosphorous poisoning, or anthrax (or any other disease the Home Secretary may add to this list), contracted in any factory or workshop, must notify the case, if not already notified, to the Chief Inspector of Factories at the Home Office, London. Failure to notify is punishable by a fine not exceeding forty shillings.

There is no hard and fast line of action for a medical practitioner who suspects or believes that his patient is being poisoned. While he is only suspicious, silence and observation may be best. But when his suspicion has increased to belief, his conduct must necessarily vary according to the circumstances of the case. It may be advisable, in the first place, to express his belief to the patient or a relative or attendant. It is certainly not wise to go straight to the police authorities in every case.

When called to a case of poisoning, a medical man should not only use every means for the purpose of relieving his patient, but also observe, as carefully as possible, the exact nature and order of the symptoms, the general surroundings, and every other condition that may form an important proof—perhaps the only proof—of poisoning, since this can occur without any trace of poison being discoverable. All suspected substances, vomited matter, and stains on dress or elsewhere, should be preserved for further examination.

In investigating the **history of a case** of poisoning, inquiry should be made with regard to the patient's previous state of health, the nature of the onset of the symptoms, whether sudden or gradual or after eating or drinking, and whether other persons were affected with similar symptoms at the same time or not.

To avoid confusing details, the fatal dose and period given under each poison are, with few exceptions, those that have occurred in acute cases in adults. Prominence is given to the symptoms and treatment, as quick decision and action are essential in treating a case of acute poisoning.

It is usually impossible for a general practitioner to make complete **chemical analyses**, since he has neither

the facilities nor the necessary practice. They are best made by public analysts, or, by order of the coroner, at the Home Office. It is necessary, however, that a practitioner should be familiar with the characteristic tests which may assist diagnosis, and with the guiding principles in making a systematic analysis. The order recommended by analytical chemists is, to search first for volatile poisons, then for alkaloids, and finally for metallic poisons.

The **volatile poisons**, *e.g.*, prussic acid, phosphorus, carbolic acid, alcohol, chloroform, and ether, can be separated by distillation.

The **alkaloids** can be extracted by one of the modifications of Stas' process, which depends on the fact that the salts of the alkaloids are soluble in ethyl alcohol and water, but not in ether, while most of the uncombined alkaloids are soluble in ether but not in water.

Briefly, the process is as follows : The alkaloids are first extracted as salts by slightly acidulated alcohol, and then dissolved in water. From this solution ether removes organic matter, including cantharidin, colchicine, digitalin, and picrotoxin, with traces of atropine and veratrine. The acid aqueous solution, which contains the other alkaloids, is then made alkaline by carbonate of sodium, and from this ether removes the uncombined alkaloids (except morphine), which, as already mentioned, are soluble in ether, but not in water. Morphine can be extracted from the alkaline solution by a mixture of equal parts of acetic ether and ordinary ether.

The **metals** can be separated from organic matter by the *moist method*. The substance is made into a thin gruel with water, then mixed in a flask with chlorate of potash, and afterwards with pure hydrochloric acid. In this condition it is heated on a water-bath, when chlorine is

evolved and destroys the organic matter, while the metals are liberated and dissolved in the acid liquid. The free chlorine is then driven off, the liquid filtered hot, and, when cooled, treated with sulphurous acid gas to reduce the metals to a lower state of oxidation. As silver chloride is insoluble in hot or cold water, it does not pass through the filter, and must be searched for separately.

ACONITE,

or Monkshood, has been the cause of accidental, suicidal, and homicidal poisoning. All parts of the plant, particularly the roots, are poisonous, as they contain the alkaloid aconitine, which has killed in smaller quantity than any other poison. The roots have been eaten instead of horseradish. Death is due to arrest of respiration or circulation, or both, and has occurred in an hour and a quarter. Sixty grains of the root and a twentieth of a grain of the alkaloid have been fatal doses.

The **symptoms** begin early with tingling and numbness of the tongue, mouth, and throat, followed by vomiting and pain over the epigastrium. Paralysis attacks the sensory nerves, extending from the peripheral endings, and producing a feeling of tingling and numbness all over the body, succeeded by staggering gait and, eventually, inability to walk. The pulse is reduced in frequency, force, and tension; respiration becomes slow and laboured; and the temperature falls. Convulsions may occur towards the end, but the mind is usually intact throughout.

The **treatment** is: empty the stomach with the pump, or tube, or an emetic. Give digitalis and stimulants hypodermically, and nitrite of amyl by inhalation. Perform artificial respiration, and apply heat. If parts of the plant have been taken, clear out the bowels with castor-oil.

Post-mortem examination reveals congestion of the venous system, and perhaps of the stomach and small intestines, where fragments of the plant may be found. The brain and its membranes are usually congested, and sub-pleural ecchymoses have occurred.

There is no reliable chemical **test** for the alkaloid. When applied to the tongue, it produces a peculiar tingling sensation, followed by numbness.

The effect produced on a mouse by a subcutaneous injection of the substance supposed to contain the alkaloid should be compared with the effect on another mouse similarly treated by a known quantity of aconitine.

Aconite and horseradish roots are distinguished from each other as follows: Those of aconite are cone-shaped and give off curling rootlets; their scrapings are friable and succulent, and impart a tingling sensation to the tongue. Those of horseradish are cylindrical, with straight rootlets; their scrapings are tough and stringy, and have a sweetish, pungent taste.

ALCOHOL

Acute alcoholic poisoning is usually caused by drinking excessive quantities of spirits, wine, or beer; but it can result from breathing air impregnated with the poison. The state is familiar enough as 'drunk and insensible.' It can occur accidentally, but is seldom produced with intent to destroy life.

Death is due to general depression of the nervous system, and may occur in five minutes if a large dose has been taken. Five ounces of absolute alcohol would probably be fatal.

If the poison has been taken in a dilute form, the **symptoms** almost always begin with a variable period of excitement, followed by general depression, indicated

by mental confusion, impaired speech, and diminished power of motion. Breathing becomes slow, laboured, and stertorous, and gives off a characteristic odour; the pulse is quick and feeble, and the pupils are usually dilated. This condition increases to profound depression, with insensibility. Coma, which is the final result, may occur in a few minutes, without the preliminary stage of excitement, if the dose has been large and concentrated.

When a person is found motionless and insensible, it may be difficult, or even impossible, to say, on first examination, whether he is suffering from alcoholism, opium-poisoning, cerebral hæmorrhage, compression or concussion of the brain, diabetic or uræmic or post-epileptic coma, or hysteria. Moreover, more than one of these conditions may exist at the same time. For example, a person under the influence of alcohol, or attacked by diabetic coma, may fall and receive compression or concussion of the brain.

Although the circumstances of the case may point to alcoholism, yet, if there is another probable cause that cannot be excluded, it is best not to give an opinion, especially in police cases, till after the lapse of sufficient time for the effects of alcohol, if any, to pass off; but, in the meanwhile, to treat the case as cerebral hæmorrhage.

If the condition of the patient is due to one cause only, the following points may assist in making a **diagnosis**:

In alcohol poisoning, as already stated, the pupils are usually dilated, the pulse is quick and feeble, respiration is slow and laboured, and the odour of the poison may be in the breath.

In opium poisoning, the pupils are contracted, the pulse

is first quick and feeble, then slow, respiration is laboured and stertorous, and the odour of the poison may be given off in the breath.

In cerebral hæmorrhage there is hemiplegia; the pupils are dilated, but if hæmorrhage is into the pons they are contracted; breathing is stertorous.

In compression of the brain there may be signs of injury to the head; respiration is slow, laboured, and stertorous, the pulse is slow and full, the pupils are dilated, and the temperature may be raised.

In concussion of the brain, no sign of direct injury to the head may be found; respiration is slow, shallow, and perhaps sighing, the pulse is feeble and may be increased, and the pupils are usually contracted.

In diabetic or uræmic coma there is, as a rule, a history indicating the cause, and the urine contains either sugar or albumin. In every case of unconsciousness in which the cause is doubtful, the urine should be drawn off and examined.

In post-epileptic coma, the tongue may be found injured by the teeth, the patient is usually young and has had fits, and the condition is more like profound sleep than coma.

In hysteria, the patient is a female, the pulse and temperature are probably normal, and the state of unconsciousness may resemble that in meningitis.

Treatment.—Empty the stomach with a hypodermic injection of apomorphine or with the pump, wash it out and fill it with strong warm coffee. Give ammonia and strychnine hypodermically. Secure a free supply of fresh air, perform artificial respiration, and, if necessary, apply sinapisms.

On **post-mortem** examination the odour of alcohol may be given off. There is congestion and sometimes inflam-

mation of the stomach and duodenum; the brain and lungs may be congested; the blood is fluid and dark; and the onset of putrefaction is slow.

Tests.—A solution of alcohol heated with strong sulphuric acid and a few drops of bichromate of potash solution gives off the odour of acetic acid and becomes green.

A solution treated with a little aqueous solution of iodine in iodide of potassium, and then with caustic potash until the iodine is decolourized, yields, after heating, a crystalline precipitate of iodoform.

AMMONIA

Poisoning by ammonia is usually produced accidentally by giving it instead of some other drug, or in excessive doses in syncope. Ammonia dissolved in water is commonly known as ‘spirit of hartshorn.’

After inhalation, the **symptoms** of asphyxia appear at once. They are due to congestion of the larynx and bronchi, which may cause death in a few minutes. The **treatment** consists of moistening the air with steam, and, if necessary, applying leeches to the throat or performing tracheotomy. **After death** the appearances are those of asphyxia, with congestion or inflammation of the air-passage.

When the poison is swallowed, its **effects** generally, and the **treatment**, are the same as in poisoning by caustic potash or soda. Death has occurred in a few minutes; and one drachm of the strong liquor has been fatal.

Tests.—Its characteristic odour. Nessler’s reagent added to a solution produces a reddish-brown colour or precipitate. If putrefaction has begun, the ammonia detected may be altogether due to this process.

ARSENIOUS ACID,

or white arsenic, as a poison, is the most important arsenical compound. It is not often used by the suicide, but it is a favourite with the homicide, as it is odourless, colourless, almost tasteless, and therefore easily administered in food. It is occasionally the cause of accidental poisoning through its use as a vermin-killer, as a sheep-wash, in destroying spores of fungi in grain, and in fly-papers. Fatal results have followed its application to cancers and other tumours—a practice common among quacks.

Two grains have been fatal; but recovery has taken place after swallowing an ounce, by reason of its emetic effect. Death has occurred as early as twenty minutes, and is due to gastro-intestinal irritation and depression of the nervous system, which follow not only the internal administration of the poison, but also its absorption from the skin.

The **symptoms** appear early, usually in from half an hour to an hour, especially if a large dose has been taken on an empty stomach. They begin with heat and constriction in the throat, and thirst. There is vomiting and pain in the stomach; tenderness over the abdomen, diarrhoea and tenesmus; and the motions may resemble those of Asiatic cholera. Faintness and depression supervene, the pulse is quick, thready, and irregular, and respiration is laboured. The skin becomes cold and clammy, cramps occur in the calves of the legs, and depression is followed by prostration, and finally coma, which may be preceded by convulsions or paralysis.

In some cases the most marked symptoms are those

of gastro-intestinal irritation ; in others, those of depression of the nervous system.

Treatment.—Empty the stomach with an emetic, or the pump used cautiously. Give freshly-prepared moist peroxide of iron, made by adding ammonia-water to tincture of perchloride of iron, straining the precipitate and mixing it with water ; or, if this cannot be done, give calcined magnesia or dialysed iron. Administer stimulants by the mouth or hypodermically, olive-oil or milk, and mucilaginous drinks. Empty the bowels with castor-oil.

On **post-mortem** examination, the stomach and bowels are found inflamed, although the poison may have entered only by the skin. The stomach is rarely perforated, but, if the poison has been swallowed, its surface may present small whitish patches of arsenic surrounded by more intense inflammation than elsewhere. The brain and lungs may be congested, and serous effusions may exist. If large doses have been taken, putrefaction may be delayed, and the effects of the poison on the alimentary canal may be visible several months after death.

Arsenic is not a normal constituent of the body, and no trace of it may be found if the acute symptoms have been survived for two or three days. It sometimes exists in minute quantities in the soil in graveyards, but always in an insoluble state, usually in the form of arsenical iron pyrites. This source of the arsenic found in an exhumed body can be excluded if the poison occurs in the body in large quantities, or if its effects during life are preserved.

Cases of *chronic arsenical poisoning* are sometimes due to repeated small doses given with homicidal intent. They have been frequently caused by arsenical colouring matter on wall-paper and other articles, and are liable to occur

among those employed in trades in which the poison is much used, as in preserving the skins of animals, paper-glazing, and white enamelling. The presence of arsenic in beer, and its poisonous effects, especially peripheral neuritis, have been prominently before the public.

The symptoms in chronic cases resemble those in acute cases, but are less severe, and include, in addition, catarrhal inflammation of the eyes, nose, and throat, loss of appetite with emaciation and exhaustion, sometimes skin eruptions, and peripheral neuritis.

The chief **tests** are Marsh's and Reinsch's.

In Marsh's process the essential apparatus is a flask, through the stopper of which pass a funnel, that dips into the liquid in the flask, and an exit tube. Hydrogen is generated in the flask from pure zinc and sulphuric acid diluted with water, and burns on ignition as it escapes from the exit tube. When arsenic is added through the funnel, it combines with nascent hydrogen, and arseniuretted hydrogen is formed. This gas is conducted by the exit tube through calcium chloride to dry it, and imparts a pale, livid colour to the hydrogen flame. A porcelain dish pressed on this flame receives a deposit of metallic arsenic. If part of the exit tube is heated to redness, the gas passing through is decomposed, and arsenic is deposited in the tube a short distance beyond the heated part.

These deposits are distinguished from similar deposits of antimony by being dissolved by a solution of bleaching-powder.

In Reinsch's process the solution of arsenic is mixed in a test-tube with one-sixth its volume of pure hydrochloric acid; a few slips of pure bright copper-foil are then added, and receive a deposit of arsenic when the mixture is boiled.

If the deposits by both processes are washed with water, dried, and then heated in a reduction-tube, metallic arsenic is volatilized and deposited as arsenious acid on the cool part of the tube in the form of octahedral and tetrahedral crystals.

When similar deposits of antimony are volatilized in a reduction-tube, the resulting deposit is amorphous.

Deposits of mercury also are obtained on copper-foil by Reinsch's process; but when these are sublimed the mercury is again deposited as minute globules free from crystals.

A bright yellow precipitate is obtained if an aqueous solution of arsenious acid is treated first with nitrate of silver, and then, gradually, with a weak solution of ammonia.

BELLADONNA

Poisoning by Belladonna, or Deadly Nightshade, is usually accidental: by the internal or external use of medicinal preparations; or, among children, by swallowing parts of the plant, particularly the berries; or by eating the flesh of animals that have fed on the leaves.

The active principle is atropine, an alkaloid found in all parts of the plant. Half a grain of it and a drachm of belladonna liniment have been fatal doses. Death is due to paralysis of the heart and lungs, and has occurred in twelve hours after administration of the alkaloid, but as early as four hours after an enema of a decoction of the root.

The **symptoms** begin in a few minutes, with dryness and heat in the mouth and throat, and intense thirst. There is a feeling of constriction in the throat, with difficulty in swallowing; nausea and vomiting occur, especially if parts

of the plant have been swallowed; the pulse becomes quick and feeble; and respiration is at first a little slowed, then quickened. Dilation of the pupils, with paralysis of accommodation, is a marked feature. The skin may be red and irritated. At first there is mental excitement and often delirium, but stupor supervenes and may be accompanied or preceded by convulsions.

Treatment.—Empty the stomach with the pump or an emetic. Give tannic acid or strong tea; pilocarpine (to be repeated in an hour if the pupils are dilated and the skin dry) and strychnine, hypodermically. Morphia may be necessary to allay excitement. Draw off the urine and empty the bowels with castor-oil. Artificial respiration may be required.

The **post-mortem** appearances are not characteristic. If parts of the plant have been taken they may be found in the alimentary canal, which, with the brain and lungs, may be congested.

Tests.—A very weak solution of atropine applied to the eye dilates the pupil. Cocaine also has this effect, but not to the same extent, and dilatation is accompanied by local anæsthesia.

Phenolphthalein is reddened by free atropine.

The isomerics atropine, hyoscyamine and duboisine are not distinguishable from each other, with certainty, by chemical or physiological tests. Daturine, the active principle of stramonium, is a mixture of atropine and hyoscyamine.

CALABAR BEAN

All the fatal cases of poisoning by Calabar Bean and its preparations have been due to swallowing them. But symptoms of poisoning sometimes occur after the

application of eserine or physostigmine, the active alkaloid, to the eye to contract the pupil. Death is caused by paralysis of the respiratory centres and gastro-intestinal irritation, and it may occur within an hour. Six beans have been fatal in a boy aged six years.

The **symptoms** are those of gastro-intestinal irritation—vomiting, abdominal pain, and frequent diarrhœa—together with difficulty in breathing which increases to asphyxia. The pulse becomes slow and feeble, the pupils contract, and giddiness and faintness are followed by profound prostration

With regard to **treatment**, empty the stomach with the pump or tube or an emetic. Give tannin and stimulants; atropine and, in case of prostration, strychnine hypodermically. Heat and artificial respiration may be necessary.

The general appearances **after death** are those of asphyxia. The stomach and bowels may be congested.

Tests for Eserine.—When a dilute solution of atropine is dropped into the eye, the pupil contracts in a few minutes.

Strong sulphuric acid dissolves atropine, the solution becoming first yellow, then olive-green.

CANTHARIDES

The toxic effects of cantharides are due to cantharidin, and can follow its application to the skin as well as its internal use. It is sometimes given internally to produce abortion, but when this follows, it is due not to the direct effect of the poison on the uterus but to reflex action through gastro-intestinal irritation, and the woman usually dies.

Cantharidin irritates the genito-urinary organs as well as the gastro-intestinal tract, and causes death by paralyzing the respiratory centres. Twenty-four grains of

powdered cantharides and one ounce of the tincture have been fatal doses, and death may occur in less than twenty hours.

The chief **symptoms** are : burning pain in the mouth and throat, with thirst and difficulty in swallowing ; nausea, vomiting, severe pain in the abdomen, and diarrhœa ; and a constant desire to pass water, accompanied with strangury, pain in the loins and irritation and swelling of the genital organs. Sometimes delirium and convulsions occur.

Treatment.—If possible, empty and thoroughly wash out the stomach. Give demulcents, stimulants, and morphine, but *not* fatty or oily substances.

Post-mortem, the alimentary canal is found inflamed, sometimes eroded, and may contain particles of Spanish fly. The kidneys, bladder, urethra, and uterus, are generally inflamed.

Test.—Cantharidin applied to the skin produces a blister.

CARBOLIC ACID

poisoning is frequently accidental, more often suicidal. This is the most frequently fatal of the common poisons used by suicides, more cases occurring among women than among men. In the few cases in which it has been given with homicidal intent, the victims were children.

Its toxic effects can be produced by its vapour or its application to the skin, as well as by its internal administration. It paralyzes the nervous system. Death is due to paralysis of the cardiac and respiratory centres, and has occurred as early as five minutes. One drachm given internally has been fatal.

After swallowing the poison, the **symptoms** begin, at once, with pain as far as the stomach, the mucous

membrane of the mouth appearing white and corroded ; but vomiting is rare. The pulse becomes rapid and feeble, or even imperceptible, respiration is stertorous, the breath gives off the odour of the poison, the pupils contract, the temperature falls, the skin becomes cold, and the urine is suppressed or diminished. Frequently there is delirium and a general condition resembling intoxication. Finally, the case ends in stupor and coma.

On the skin, strong carbolic acid acts as a caustic, producing a white appearance and making the epidermis easily peeled off. After absorption from the unbroken skin or a sore, the general symptoms are similar to those just described, but, of course, those due to direct action of the poison on the alimentary canal are absent.

Treatment.—If the poison has been swallowed, give lime-water or the saccharated solution of lime, or a solution of sulphate of sodium or magnesium. If the soft tube can be used, empty the stomach, wash it out with one of these solutions, and give white of egg and milk, or olive-oil. In any case, give stimulants hypodermically. Heat and artificial respiration may be necessary.

On **post-mortem** examination the odour of the poison is easily detected. The mucous membrane from the lips to the stomach is whitened, corroded, and in parts detached ; the abdominal viscera, the lungs, and sometimes the brain, are congested ; the blood is fluid, becoming bright red on exposure to the air ; and the urine is olive-green.

Tests.—Carbolic acid can be separated from organic matter by distillation with dilute sulphuric acid, and from urine by shaking it up with ether. It has a characteristic odour. A solution of it turns blue on the addition of liquor ammonia and chlorinated lime, or purple if treated with perchloride of iron.

It is eliminated from the body in three or four days. Therefore, if it is found in more than normal amount in the urine, it must have been taken into the system during the last three or four days of life.

CARBON BISULPHIDE

is rarely the cause of acute poisoning; but its vapour is liable to produce chronic toxic effects in indiarubber and guttapercha works. Its acute fatal action is paralysis of the respiratory centres. Death has occurred in two hours and a quarter, and has followed a dose of half an ounce.

The **symptoms** are: slow laboured breathing with the odour of the poison in the breath, quick feeble pulse, cold clammy surface, and general collapse.

Treatment.—Use the stomach-pump, give stimulants, apply heat, and, if necessary, employ artificial respiration.

Post-mortem, the odour of the poison is given off, the stomach may be congested, and the blood may be fluid and black.

In *chronic poisoning*, through inhaling the vapour, the symptoms begin with loss of appetite, gastro-intestinal irritation and headache. Neuritis follows, and there may be wrist-drop or ankle-drop. Sometimes the symptoms are similar to those of delirium tremens.

Test.—It can be separated by distillation, and has a characteristic odour. It gives a black precipitate on heating with lead acetate and potash.

CARBONIC ACID

As this gas is given off in respiration and combustion, it is very liable to produce its toxic effects if ventilation is defective. It has been a frequent cause of death in coal-

mines, where it is known as 'choke-damp.' Lime- and brick-kilns give it off, and it may escape during the manufacture of aerated waters.

Death is due to asphyxia, the blood being imperfectly oxygenated and freed from carbon dioxide. An atmosphere containing ten per cent. of respiratory carbonic acid would probably be fatal.

When the *undiluted* gas is inhaled, sudden spasm of the glottis and unconsciousness may be followed almost immediately by death. In the *diluted* state, in which it acts less rapidly, the **symptoms** are: giddiness, noises in the ears, pressure and throbbing at the temples, and headache; general signs of asphyxia appear, with stertorous breathing and palpitation of the heart; and the patient loses muscular power, gradually becomes unconscious, and finally sinks into comà. Death is sometimes ushered in by convulsions. No poisonous effects appear to be caused by taking carbonic acid into the stomach.

Treatment.—Remove the patient into pure air, perform artificial respiration, and apply heat. Give oxygen by inhalation, and stimulants by the mouth or subcutaneously.

Asphyxia is the chief **post-mortem** feature.

Test.—When carbonic acid is shaken up with lime-water or baryta-water a white precipitate is formed.

CARBONIC OXIDE

poisoning, in this country, is usually accidental; but in France it is frequently suicidal and homicidal. Most cases are due to inhaling the gas, either when it is given off by burning charcoal or coke in bedrooms from which the fumes cannot escape, or when it occurs in coal- or

water-gas, of which it is the chief poisonous constituent. It is given off from brick- and lime-kilns. It is an accumulative poison, and its danger is increased by the fact that it has no odour.

The cause of death is asphyxia, due to the formation of a fixed compound with hæmoglobin, which prevents the absorption and transmission of oxygen by the blood. The affinity of carbonic oxide for hæmoglobin is said to be as much as two hundred times greater than that of oxygen. An atmosphere containing one-tenth per cent. of carbonic oxide would most probably be fatal.

The symptoms are : giddiness, with throbbing and pain in the head and noises in the ears; nausea, and occasionally vomiting; small or imperceptible pulse; and prostration which becomes marked and passes into insensibility and coma.

In the **treatment**, secure fresh air, perform artificial respiration, apply heat, give oxygen by inhalation and stimulants hypodermically. Transfusion of arterialized defibrinated blood may be useful.

Post-mortem, there are bright pink stains on the surface, and the blood has a characteristic cherry-red colour which is produced by the combination of the gas with hæmoglobin and remains for a long time. Rigor mortis is prolonged and putrefaction begins later than usual.

Tests.—Diluted carbonic oxide blood becomes red when caustic soda is added to it on a white porcelain dish, whereas normal blood similarly treated turns brownish-green.

Carbonic oxide blood gives a characteristic spectrum, consisting of two bands almost similar in appearance and position to those in the spectrum of diluted oxyhæmoglobin, but are a little nearer the violet end. The

addition of yellow sulphide of ammonium produces no change, but converts the spectrum of oxyhæmoglobin into that of reduced hæmoglobin.

If the blood contains oxyhæmoglobin as well as carbonic oxide hæmoglobin, the spectrum, on the addition of the reducing agent, consists of two bands on a broad one, between D and E.

The presence of carbonic oxide in the air can be shown by the spectrum of a dilute solution of blood through which the air has been passed.

CAUSTIC POTASH

poisoning is usually accidental and can readily occur, as the poison is extensively used in various industries. It is rarely homicidal, but sometimes suicidal.

Death has occurred in three hours and has followed a dose of forty grains. It is due to gastro-intestinal irritation and cardiac depression ; but, in some cases, it causes death chiefly by its caustic action on the air-passage, particularly on the epiglottis.

The **symptoms** follow immediately after swallowing the poison. There is heat and pain from the mouth to the stomach, vomiting of tough mucus mixed with blood, purging, and tenderness over the abdomen. The lips and mouth assume a red and swollen appearance. Respiration becomes difficult, the pulse small and feeble, and the skin cold and clammy. The patient finally sinks into a state of profound collapse.

If he survives the acute symptoms, which he usually does, he may die, after an indefinite period, from starvation through stricture of the œsophagus or destruction of the gastric glands.

In the **treatment**, an emetic is not necessary, and the

stomach-pump or tube must not be used. Give dilute acid solutions, such as vinegar, lemon-juice, citric or tartaric acid, in water; stimulants and, if necessary, opium hypodermically; olive-oil and demulcent drinks.

The chief **post-mortem** appearances are corrosion and inflammation of the alimentary canal as far as the stomach, which may be perforated. The larynx and lungs are sometimes inflamed, and the epiglottis may be corroded.

Tests.—A solution of caustic potash introduced into a Bunsen flame, by means of a platinum loop, imparts a violet tint to the flame. If this characteristic tint is masked by sodium, it appears when the flame is viewed through dark-blue glass.

If a few drops of platinic chloride are added to a solution of caustic potash acidified with hydrochloric acid, and the mixture stirred with a glass rod, a yellow crystalline precipitate is formed.

Alkalinity can be shown by its reaction to test-paper.

CAUSTIC SODA

What has been said about caustic potash applies generally to this poison. The fatal period and dose, **symptoms**, **treatment**, and **post-mortem** appearances are much the same in both.

Test.—Sodium imparts an intense yellow colour to the Bunsen flame; but neither this nor the spectroscopic reaction is conclusive for toxicological purposes, since this element is so extensively present. It is necessary to exclude potassium and the alkaline earths.

CHLORAL HYDRATE

poisoning is usually accidental or suicidal, but may be homicidal. The 'habit' in this, as in other poisons,

may be put forward to explain deaths due to other causes or to homicide.

Death is produced by paralysis of the heart, and has occurred in fifteen minutes. A dose of ten grains has been fatal.

The **symptoms** may begin early. There is drowsiness, small feeble pulse, laboured respiration, and, usually, contracted pupils. The reflexes become lost, the body turns cold and clammy, and the condition of drowsiness passes into coma.

Treatment.—Empty and wash out the stomach, and give strong hot coffee and a hypodermic injection of strychnine. If necessary, apply heat, perform artificial respiration, and try to rouse the patient by flicking him with a wet towel. Inhalation of oxygen may be useful.

The **post-mortem** appearances are not characteristic. The state of the heart and lungs may indicate cardiac and respiratory failure.

Test.—When a solution of chloral hydrate is shaken up with a solution of caustic potash and, if necessary, gently heated, the odour of chloroform is given off.

CHLORINE

is rarely the cause of acute poisoning. When this occurs, it is usually in chemical works or laboratories. Death is due to paralysis of the heart, and has followed within forty-eight hours after a couple of breaths of pure chlorine.

The **symptoms** likely to arise are dyspnœa, irritating cough, pain in the chest, increasing difficulty in breathing, and considerably reduced pulse.

For **treatment**, provide steam inhalations and fresh air, and give cardiac stimulants.

The **post-mortem** appearances may be those of asphyxia, and the lungs may be œdematous.

Test.—A mixture of starch and iodide of potassium is turned blue by chlorine.

CHLOROFORM

Most cases of death from chloroform occur when it is given as an anæsthetic. It is possible to anæsthetize a person in deep sleep, but not by merely waving a handkerchief containing chloroform or ether before the face, as is sometimes suggested. Liquid chloroform is occasionally the cause of accidental and suicidal poisoning.

Death is due to paralysis of the respiratory centres and heart, especially the former, and may occur after a single breath of the vapour, or within three hours after swallowing the liquid, of which half an ounce has been a fatal dose.

After inhalation, the **symptoms** may begin with a stage of excitement. This is followed by general anæsthesia, relaxation of the muscles, and unconsciousness. Respiration becomes slow and stertorous, the pulse slow and weak, the pupils dilated, and the conjunctiva insensible to touch. The face turns pale, the body becomes cold, and profound coma ends in death.

Treatment.—Remove the vapour, draw the chin upwards and the tongue forwards, admit fresh air, apply nitrite of amyl to the nostrils, perform artificial respiration, and give stimulants and strychnine hypodermically. Cold affusions may be useful, and inversion of the body has been done with successful results.

When liquid chloroform is swallowed, the **symptoms** are like those just described, together with gastro-intestinal

irritation. The latter is usually absent, or in some cases confined to vomiting, when the poison is inhaled.

Treatment.—Empty the stomach with the pump or an emetic, and proceed as in poisoning through inhalation.

The **post-mortem** appearances are not characteristic. The peculiar odour of chloroform may be given off; the blood is frequently dark and fluid; the lungs and, if the poison has been swallowed, the alimentary canal may be congested.

Tests.—The odour is characteristic.

If, by means of a suitable apparatus, chloroform is evaporated and passed through a heated tube, it is decomposed, with the production of chlorine and hydrochloric acid. The presence of chlorine is shown by passing the heated vapour through a mixture of starch and iodide of potassium, which it turns blue; and of hydrochloric acid, by leading it into a solution of nitrate of silver, where it throws down a white precipitate insoluble in nitric acid, but soluble in ammonia.

COCAINE

This alkaloid is extensively employed as a local anæsthetic, and can produce its toxic effects when it is applied externally as well as when it is swallowed. The ‘cocaine habit’ has become a common occurrence.

Cocaine paralyzes the centres of the brain and spinal cord. Death, which is due to respiratory paralysis, has been caused by two-thirds of a grain given hypodermically, and has occurred in twenty minutes.

The usual acute **symptoms** are: faintness, pallor and cold sweats, laboured respiration, slow intermittent pulse, and dilated pupils. Delirium and convulsions may occur.

Treatment.—If the poison has been swallowed, empty and wash out the stomach. Give strychnine hypodermically, and stimulants. Perform artificial respiration if necessary, and, if convulsions occur, give chloroform by inhalation.

Post-mortem, there is congestion of the viscera and central nervous system ; but this is not characteristic.

Tests.—A salt of cocaine, in solution, applied to the tongue, produces a bitter taste and loss of sensation.

If cocaine is added to a mixture of a few drops of strong sulphuric acid with powdered resorcin in a porcelain dish, a blue colour is produced, which changes to light rose on the addition of caustic soda.

CONIUM,

or spotted hemlock, is rarely used by the homicide or suicide. It is usually fatal by accident, either in the form of medicinal preparations, or when parts of the plant are taken by mistake, the roots for parsnips and the leaves for parsley.

All parts of the plant are poisonous, since they contain the alkaloids conine and methyl-conine.

Conium paralyzes the motor nerves, beginning at the peripheral terminations and extending to the centres. Death is due to paralysis of the respiratory nerves and centre, and occurs in from one to three hours. One or two minims of conine would probably be a fatal dose.

The **symptoms** may begin in a few minutes with dryness and constriction in the throat, nausea, and vomiting. Muscular weakness soon sets in, commencing at the lower extremities, and extending to the trunk ; it compels the patient to lie down, and increases to complete paralysis.

Respiration becomes slow and difficult, the pulse is feeble, and the pupils are dilated. As a rule, the mind is not affected till near the end, which is ushered in by convulsions and coma.

In the **treatment**, empty the stomach with the pump or an emetic. Give tannin and stimulants internally, and strychnine hypodermically. Perform artificial respiration, and apply heat. Empty the bowels with castor-oil.

The **post-mortem** appearances may be those of asphyxia, but they are not characteristic. The alimentary canal may be congested and contain parts of the plant.

The chief **test** for conine, which is liquid and volatile, is its physiological action on animals. Injected under the skin, it produces paralysis, beginning in the posterior extremities, as in man.

It is distinguished from nicotine, which is also a liquid and volatile alkaloid, by mercuric chloride. This gives with conine a white amorphous precipitate, but with nicotine a white precipitate which turns yellow and crystalline.

COPPER

The sulphate, or blue vitriol, and the basic acetate, or verdigris, are the salts of copper that usually cause acute poisoning. They have been used with suicidal and homicidal intent, and cases of poisoning have occurred through their administration to produce abortion.

They act as gastro-intestinal irritants and general depressants. An ounce of the sulphate and the same quantity of the acetate have been fatal doses. Death has occurred in four hours after a dose of the sulphate.

The **symptoms** begin early, with metallic taste, thirst, violent vomiting, purging, and pain in the abdomen. The

vomited matter is at first green or blue in colour, but, on the addition of excess of ammonia, it becomes deep blue, whereas bile remains unchanged. Respiration becomes irregular, and finally coma ensues.

Treatment.—Give warm water and white of egg, and, if the resulting albuminate of copper is not vomited, thoroughly wash out the stomach with the pump or tube. After this give demulcents and milk. Stimulants may be necessary. Opium may be required to relieve pain and excessive vomiting.

Post-mortem, the alimentary canal is found inflamed, and perhaps coloured blue or green.

Cases of *chronic poisoning* are apt to occur through the use of copper vessels for cooking acid food-stuffs, or for containing articles of food in the cold; or after the consumption of vegetables greened with copper; or in employments in which the metal is extensively used. The most prominent symptoms are: vomiting, diarrhœa and colicky pain, dyspepsia and loss of appetite; sometimes a green line on the margin of the gums; cramps, 'wrist-drop,' or some other form of peripheral neuritis.

Tests.—With a solution of a copper salt: ferrocyanide of potassium gives a reddish-brown precipitate; solution of ammonia gives a light-blue precipitate, changing, on addition of excess of the reagent, to a dark-blue solution; and a bright steel surface is soon coated with metallic copper.

ETHER

Death from this poison is always due to inhaling the vapour, and then almost always when it is used as an anæsthetic. In some districts liquid ether is drunk as a substitute for alcohol, which it resembles in its action, but is more evanescent.

The vapour acts fatally by paralyzing the respiratory centres and heart. There is no recorded case of death through swallowing the liquid. One fluid ounce would probably be a fatal dose if swallowed by an adult not accustomed to its use.

The **symptoms** and **treatment** after inhalation are similar to those in poisoning by chloroform vapour ; but after swallowing the liquid they are much the same as in acute poisoning by alcohol.

Post-mortem, the conditions resemble those in poisoning by inhalation of chloroform. The penetrating odour of ether may be given off, especially from the brain and liver. The vessels of the upper part of the spinal cord are markedly congested.

Test.—Sulphuric acid and bichromate of potash give the same reactions with ether as with alcohol. But ether is distinguished by its peculiar penetrating odour, and by floating on water, whereas alcohol mixes with water.

FOOD

has often been used as a vehicle for administering poisons, and is frequently adulterated or contaminated with them. The flesh of animals may contain poisons eaten as food or given as drugs.

Toxic effects produced by food that has not undergone putrefaction are frequently due to poisons with which it has been in contact, *e.g.*, lead and copper.

Poisoning by putrid food may be due to ptomaines, or albumoses, or toxines, or directly to bacteria, the **symptoms**, as a rule, being those of gastro-intestinal irritation, or depression or excitement of the nerve centres, or a combination of these. The temperature is usually raised,

and there may be erythematous or urticarial conditions of the skin.

Toxines can be formed in animals during life, as in mussels living in water contaminated with sewage, and may produce symptoms similar to those due to putrid meat.

The **treatment** consists of emptying the stomach and bowels, and giving stimulants or sedatives, according to the symptoms. Heat and artificial respiration may be necessary.

After death, some of the poisonous food may be found in the alimentary canal, which, together with the liver and kidneys, may be congested or inflamed.

Chemical or bacteriological examination may be required to discover the poison.

HYDROCHLORIC ACID,

like the other mineral acids, is very liable to cause accidental poisoning, through its extensive use under the name of 'spirits of salts.' It can be fatal not only in the liquid form, but also as fumes. Death has occurred in two hours after swallowing the poison, and has resulted from a dose of one drachm of the strong acid.

When the poison is swallowed, the action, **symptoms**, **treatment**, and **post-mortem** appearances are much the same as in sulphuric acid poisoning; but there are no stains on the skin, while those on cloth are dry, and if on black cloth they are green or dark.

It is less corrosive than sulphuric or nitric acid. The stomach is rarely perforated, and does not present the same amount of blackening as in poisoning by sulphuric acid.

When the fumes are inhaled, the effects and treatment are the same as after inhalation of the fumes of nitric acid.

Tests.—The acidity can be shown by litmus-paper.

Nitrate of silver added to a solution of the acid throws down a white precipitate, insoluble in nitric acid, but soluble in ammonia.

As the contents of the stomach, and most organic substances, contain hydrochloric acid, free or combined, its presence alone does not prove that the symptoms of poisoning were due to it. But if the symptoms and post-mortem appearances are those of a mineral acid only, and if hydrochloric acid is found in sufficient quantity, it may with safety be regarded as their cause.

HYDROCYANIC OR PRUSSIC ACID

is one of the most frequent means employed by suicides, who are the majority, at least, of the cases of poisoning by it. Homicidal cases are rare. This poison is readily absorbed from the skin where this is abraded or otherwise injured, and it is the most virulent of all the poisons, with regard to the smallness of its fatal dose and the quickness of its action.

It forms about 2 per cent. by weight of the Pharmacopœial preparation, and is present to the extent of 5 to 15 per cent. in essential oil of bitter almonds, and 5 per cent. in Scheele's preparation.

A dose of 30 minims of the dilute acid of the Pharmacopœia has been fatal. Death has occurred in less than two minutes, and is due to depression of the nervous system, particularly the respiratory centres, caused by arrested internal respiration; that is, the power of the

red corpuscles to carry oxygen, and of the tissues to take it up, is diminished or destroyed.

The **symptoms** usually come on immediately, but may be delayed thirty seconds or a minute, and the patient may have time to alter his position or dispose of the glass or bottle that held the poison. They begin with loss of muscular power and sensibility, accompanied by slow gasping respiration and rapid feeble or imperceptible pulse. The pupils are dilated, the face is livid, the skin is cold and clammy, and a white or bloody froth surrounds the mouth. The jaws become fixed, and the hands clenched. Finally death is ushered in by general convulsions.

Treatment.—Give stimulants and atropine hypodermically, and ammonia by inhalation. If possible, empty the stomach quickly by an emetic or the pump. Perform artificial respiration, and apply cold affusions to the head and spine.

It has been recommended to give repeated subcutaneous injections of 20 minims or more of 5 to 10 per cent. solution of sodium thiosulphate, or of 0.5 to 1 per cent. solution of nitrate of cobalt.

On **post-mortem** examination care should be taken to avoid inhaling the vapour of the poison, which is liable to be given off when the body is opened, especially after a large dose. Some of the conditions produced during life are continued in death, *e.g.*, the fixed jaws, clenched hands, and dilated pupils. The blood is always arterial in colour, but sometimes dark. The internal organs are congested, and the general appearances may resemble those of asphyxia. The stains are pink.

Tests.—Nitrate of silver added to a solution of the acid throws down a white clotted precipitate, soluble in hot

strong nitric acid. If the precipitate is heated it gives off cyanogen gas, which has the odour of peach-blossoms and burns with a rose-coloured flame.

When liquor potassæ, solution of ferrous sulphate, solution of ferric chloride, and hydrochloric acid, are successively added to a solution of the acid, a dark-blue colour is produced by the formation of prussian blue.

Sulphocyanide of potassium, a non-poisonous compound, exists as a normal constituent in saliva. Hydrocyanic acid and potassium cyanide can be detected in the presence of non-poisonous double cyanides, in the contents of the stomach, by mixing these with a concentrated solution of bicarbonate of sodium and distilling. The tests for hydrocyanic acid are then applied to the distillate.

IODINE

Cases of fatal poisoning by iodine are rare. When they occur, they are usually caused by accidentally swallowing a solution of the poison or by injecting it into a cavity. It acts as a gastro-intestinal irritant and general depressant. Death has occurred in twenty-four hours, and has been caused by swallowing a dose of a drachm of the tincture.

The **symptoms** are: burning pain from the mouth to the stomach, with vomiting and diarrhœa, the vomited matter being yellow or brownish, but if starchy substances are in the stomach, it is blue. There is usually great thirst. The patient becomes collapsed, the pulse being small and feeble and the surface cold.

The **treatment** consists of emptying the stomach with an emetic or the tube, and giving cooked starch or flour. Morphia or stimulants may be necessary.

On **post-mortem** examination, the alimentary canal is

found inflamed, and parts of its mucous membrane are stained yellow.

Test.—With a cold decoction of starch iodine forms a dark-blue colour.

LEAD

poisoning usually occurs among those engaged in lead works or in occupations in which the metal or its salts are extensively used, *e.g.*, plumbers, painters, file-cutters, and compositors. It is also caused by food or water impregnated with the poison—food, by wrapping it with lead-foil or by keeping it in tins or other receptacles glazed with a substance containing lead; water, by using lead pipes and cisterns, which are specially injurious when the water is pure or contains chlorides or nitrates, or is free from carbonates, sulphates, or phosphates.

The salts that are most frequently the cause of poisoning are the acetate, or sugar of lead, the carbonate, or white lead, and the subacetate. The acetate has been taken instead of Epsom salts, from which it is easily distinguished by its sweetish astringent taste. The metal itself produces toxic effects when it is taken into the system in fine particles.

Death is due to gastric irritation and depression of the nervous system, and would probably follow a dose of one or two ounces of the acetate. The fatal period is not known with certainty.

The **symptoms** in acute cases begin with burning pain in the throat and gullet, and thirst. This is followed by vomiting and severe abdominal pain—‘colic’—relieved by pressure, and accompanied by retraction and hardness of the abdominal wall. The bowels are constipated, but dark fæces may be passed. Cramps and sometimes

paralysis attack the legs, the pulse becomes small and feeble, prostration supervenes, and death may be preceded by convulsions.

Acute cases are much less frequent than *subacute or chronic poisoning*, in which there is 'colic' and constipation, the skin becomes sallow, nutrition is impaired, pains occur in and about the joints, particularly the knee-joints, and a blue line exists on the margin of the gums where there are teeth. Paralysis occasionally occurs, most frequently as 'wrist-drop' which is characterized by paralysis of the extensor muscles of the wrist and fingers, the interossei and supinator longus usually escaping.

Treat, in acute cases, by emptying the stomach with the pump or an emetic of sulphate of zinc, and giving sulphate of magnesium or of sodium dissolved in water, white of egg and milk, stimulants hypodermically, and, if necessary, opium. Warm fomentations over the abdomen may relieve the pain of 'colic.' In chronic cases the treatment recommended is hot baths and massage, with an occasional purge.

The principal **post-mortem** appearance, in acute cases, is inflammation of the alimentary canal, the mucous membrane of which may be corroded or contain a salt of lead. In chronic cases, the metal may be found in the tissues, fatty degeneration in the paralyzed muscles, and atrophy in the nerves, intestines, and elsewhere.

Tests.—From a solution of a lead salt: sulphuretted hydrogen throws down a black precipitate; and chromate of potash a bright yellow one, which changes to orange-red when boiled with caustic potash.

MERCURIC CHLORIDE,

or corrosive sublimate, is, in toxicology, the most important compound of mercury. It is rarely used by the suicide or homicide, most cases of poisoning by it being accidental on account of its extensive use as an antiseptic, preservative, and insect-destroyer. Symptoms of poisoning may follow its injection into cavities, or its application to the unbroken skin, or to tumours—a practice common among quacks in treating so-called cancers.

Death is caused by gastro-intestinal irritation and corrosion, and may occur in half an hour. Five grains would probably be a fatal dose.

The **symptoms**, which follow immediately after swallowing a poisonous dose, are: metallic taste; feeling of heat and constriction in the throat and gullet; vomiting of white slimy substance; abdominal pain which is increased by pressure; and purging, the motions frequently containing blood. The pulse becomes small and irregular, the skin cold and clammy, and the patient sinks into a general condition of collapse which may be preceded by convulsions.

Chronic poisoning is apt to follow repeated small doses of this or some other preparation of mercury, or its frequent application to the skin, or the inhalation of the vapour of mercury, and is particularly liable to occur among those employed in works in which the metal is used, as in the manufacture of barometers and mirrors. The most prominent symptoms are salivation and tenderness of the gums, which have a dark line near their union with the teeth, gastro-intestinal irritation,

skin eruptions, cachexia, physical and mental depression, and tremors.

Treat, in acute cases, by giving white of egg or flour and milk, and then emptying the stomach by means of an emetic by the mouth, or by apomorphine hypodermically, to get rid of the resulting albuminate. Avoid the pump or tube. Administer demulcents and, if necessary, opium.

After death in acute cases, the mucous membrane from the lips to the end of the œsophagus may be found whitened, swollen, and corroded. The stomach may be inflamed, sometimes corroded, but very rarely perforated, although the inflammation may extend to the peritoneum. The intestine, particularly the colon, is generally inflamed.

Tests.—Iodide of potassium added to a solution of mercuric chloride throws down a crimson precipitate soluble in excess of the reagent or of the chloride.

Copper-foil immersed in a solution slightly acidulated with hydrochloric acid is, on boiling, coated with mercury, which sublimes when heated in a reduction-tube, and is again deposited in the form of globules.

MUSHROOMS

There are no fixed characters by which non-poisonous can be distinguished from poisonous mushrooms. The poisonous varieties contain the toxic principles muscarine and phallin. *Muscarine* acts like pilocarpine, and is antagonistic to atropine. *Phallin* produces thrombi by disintegrating the red corpuscles and liberating fibrin ferment.

The usual **symptoms** due to poisonous fungi are : gastro-intestinal irritation and collapse ; there may be delirium

and convulsions; and the urine may contain albumin or blood, or it may be suppressed.

The **treatment** consists in emptying the stomach and bowels and giving atropine and strychnine hypodermically, and morphia if there is severe pain.

After death the alimentary canal may be inflamed and contain pieces of the fungus. The liver may be in much the same condition as in phosphorus-poisoning.

The varieties eaten in this country are the common mushroom (*Agaricus campestris*) and the champignon (*Agaricus oreades*). When they produce toxic action, it is probably always due to their decomposition, and usually consists of irritation of the alimentary canal and nervous system, which can be treated by emptying the stomach and bowels and giving morphine or stimulants, according to the symptoms. In fatal cases the alimentary canal is found inflamed.

NITRIC ACID

Poisoning by this acid, commonly known as 'aqua fortis,' is usually accidental, like poisoning by the other mineral acids, and for similar reasons.

Two drachms of the strong acid have been fatal, and death has occurred as early as an hour and three-quarters.

The action, **symptoms**, **treatment**, and **post-mortem** appearances are much the same as in sulphuric acid poisoning; but the stains on the skin, lips, mouth, and clothes are yellow, those on cloth being dry. The stomach is very rarely perforated, and its mucous membrane presents a yellowish-brown colour.

The *fumes of nitric acid* can produce congestion of the air-passages and lungs, resulting in difficult breathing and

fatal asphyxia. The treatment in such cases consists in giving moist inhalations and stimulants.

Test.—Mix, in a test-tube, a few drops of a solution of brucine with a solution containing nitric acid, and gently pour pure sulphuric acid down the side of the tube so that it forms a layer at the bottom ; a pink zone appears at the junction of the two liquids.

NITRO-BENZENE,

or artificial oil of bitter almonds, is liable to cause poisoning through its use in perfumery and confectionery as a substitute for the essential oil of bitter almonds, and in the manufacture of aniline.

When inhaled or swallowed it produces dyspnœa through diminishing the power of hæmoglobin to carry oxygen to the tissues. Twenty drops have been fatal, and death may occur in from one to twenty-four hours.

Symptoms.—The toxic effects may not appear for three or four hours, very rarely earlier than a quarter of an hour. Cyanosis is the most marked symptom. The body, generally, may present an intensely blue colour, and become cold and clammy. Breathing is shallow and irregular, the breath giving off the odour of the poison, and the pulse is quick and feeble. There is headache, giddiness, unsteady gait, and perhaps vomiting, the vomited matter containing the poison. This condition rapidly passes into drowsiness and coma ; and death may be preceded by convulsions.

Treat by emptying and washing out the stomach with the tube, and giving stimulants. Alcohol should not be given by the mouth unless the stomach has been thoroughly washed out. External heat and artificial respiration may be necessary.

Post-mortem, the odour of the poison is the only characteristic feature. The blood is dark and fluid, and there is general venous congestion.

Tests.—An odour similar to that of bitter almonds.

Sulphuric acid does not affect nitro-benzene, but with oil of bitter almonds it produces a fine crimson colour.

NITRO-GLYCERINE

acts as a poison both as a liquid and as a vapour. It lowers the blood-pressure, makes the hæmoglobin less able to take up oxygen, and eventually causes death by asphyxia. Death has occurred in four hours after swallowing an ounce, but the fatal dose is not definitely known.

The **symptoms** produced are: burning sensation in the throat, and vomiting; flushed face, and severe pain in the head; general pulsation with perspiration; and difficult breathing. There may be complete paralysis.

In the **treatment**, empty the stomach and give strychnine hypodermically. It may be necessary to apply heat.

On **post-mortem** examination the blood may be found chocolate-coloured, and its spectrum is that of methæmoglobin.

Tests.—It yields a red colour when it is treated with aniline or brucine and strong sulphuric acid.

OPIUM

is the cause of more than half the deaths by poisoning in England. It is usually fatal by accident, and more often suicidal than homicidal. It is exceedingly active in children, among whom poisoning has been frequently due to its use in the form of 'soothing syrups,' 'sedatives,' and 'carminatives.' Two drops of laudanum have been fatal in an infant a few weeks old.

Toxic effects can follow the application of opium to the unbroken skin as well as its internal administration. They are caused much more frequently by opium itself or its preparations, especially the tincture, than by the separated active alkaloids, of which morphia is the most important.

Two grains of opium and half a grain of acetate of morphia have been fatal doses in adults, but recovery can take place after large doses. By habit, some persons are able to consume enormous quantities of opium daily. Death is due to paralysis of the respiratory centre, and has occurred as early as three-quarters of an hour.

The **symptoms**, as a rule, are not apparent till half an hour or an hour after swallowing the poison, as its absorption is slow. Sometimes they begin with mental activity or excitement, which is but transitory and is followed by general muscular relaxation, cerebral depression and drowsiness, passing into coma. Before this condition becomes profound, it may be possible to rouse the patient by shaking him or shouting into his ear. Nausea and vomiting may occur. In the early stage the pulse and respiration are quickened, the pupils are contracted, and the skin is warm and moist; but later the pulse becomes slow and respiration stertorous, the pupils are sometimes dilated, and the skin is cold and clammy. The breath may have the odour of the poison.

The chief results of *chronic opium-poisoning* are dyspepsia and other digestive derangements, anæmia, emaciation, halting gait, tremors, headache, and mental disturbance.

Treatment.—Empty the stomach with the pump or tube, and wash it out with a strong warm infusion of coffee or a solution of tannin. If this cannot be done, try an emetic, especially apomorphine hypodermically, or tickle the throat with a feather. It has been recom-

mended to give permanganate of potash, 8 to 10 grains, or, if the tincture of opium has been taken, 6 grains for each fluid ounce, and to repeat the dose three or four times, with intervals of half an hour. Avoid a concentrated solution of the permanganate. Give atropine or strychnine hypodermically, preferably the latter if the respiratory and cardiac symptoms are alarming. It may be necessary to perform artificial respiration.

The **post-mortem** appearances are not characteristic. There may be congestion of the brain, spinal cord, and lungs, with serous effusions and general indications of asphyxia. The body may give off the smell of opium.

The **tests** are confined to those for meconic acid and morphine.

Meconic acid is found in opium only, and can be separated by extracting with alcohol acidulated with acetic acid, then, from an aqueous solution, precipitating with acetate of lead, and finally removing the lead by means of sulphuretted hydrogen, excess of which is driven off by heat.

Ferric chloride added to a solution of meconic acid produces a deep blood-red colour, not discharged by mercuric chloride or by dilute hydrochloric acid.

A drop or two of strong nitric acid added to solid *morphine* gives an orange-red colour unaltered by stannous chloride. If a mixture of iodic acid and starch is added to a solution of morphine, a blue colour appears, due to the formation of iodide of starch.

OXALIC ACID

poisoning in this country is usually suicidal, rarely homicidal. If the latter, the poison is generally administered

mixed with such liquids as porter, beer, or coffee. Accidental poisoning sometimes occurs through taking oxalic acid instead of Epsom salts, and is very liable to happen on account of the extensive use of the acid for trade and domestic purposes, *e.g.*, in the manufacture of straw hats, for removing ink-stains, and for brightening brass.

Binoxalate of potash, or salts of sorrel, occurs in sorrel, rhubarb, and other plants, and acts as a poison much like oxalic acid, but not so powerfully. It is used for the same purposes as the acid, and has been taken instead of cream of tartar and tartaric acid.

A drachm of the acid has been fatal. Death has occurred in less than five minutes, and is due to gastrointestinal irritation and corrosion, and depression of the nervous system and heart.

The **symptoms** begin at once. There is an acid taste, with burning pain as far as the stomach, and a bleached condition of the mucous membrane of the mouth. Violent vomiting of mucus mixed with blood comes on early, together with pain and tenderness over the abdomen. This state is accompanied or succeeded by general prostration; the pulse becomes feeble and irregular, the breathing hurried and gasping, and the skin cold and clammy. Death is sometimes preceded by convulsions.

If the poison has been well diluted the symptoms may be more those of narcotic than of irritant poisoning.

Treatment.—Assist vomiting with an emetic of sulphate of zinc if necessary. Give calcium carbonate in water, in whatever form it can be most quickly obtained (as chalk, whiting, or from the ceiling or cornice of a room), or saccharated lime-water. Administer stimulants hypodermically or by the rectum, and olive-oil by the mouth. Apply heat.

Avoid alkalies, as they form soluble poisonous oxalates, and use as little water as possible, as it dilutes the solution and assists absorption.

The chief **post-mortem** appearances are corrosion and inflammation of the alimentary canal as far as the duodenum, with abrasion of the mucous membrane, which may, in parts, present a worm-eaten appearance. The adjacent organs may also be corroded, and the brain and lungs may be congested. The mouth and pharynx are whitened.

The suggestion that the oxalate found in the body was due to the use of plants containing it, or to sugar, or to disease, can be disposed of by the quantity, if this is considerable, or by the quick onset of the symptoms.

Tests.—Chloride of calcium added to a solution of oxalic acid, neutralized by ammonia, gives a white precipitate insoluble in acetic but soluble in hydrochloric acid.

Nitrate of silver added to a solution of the acid throws down a white precipitate soluble in nitric acid and in ammonia.

PHOSPHORUS

poisoning is usually suicidal. Only in rare instances is it homicidal, the smell, taste, and luminosity of the poison standing in the way of its administration for this purpose. As it is extensively used in the manufacture of matches and in rat pastes, accidental poisoning may readily occur.

Of the two forms of phosphorus, yellow and red, only the former is poisonous, luminous in the dark, and soluble in carbon bisulphide. In prolonged exposure to its vapour, as in match factories, there is great liability to periostitis and necrosis of the jaws in those who have decayed teeth.

An eighth of a grain has been fatal. Death has occurred as early as half an hour, and is due to gastro-intestinal irritation and corrosion, but in some cases to general nervous prostration.

The **symptoms** begin with the taste and odour of garlic and burning pain in the throat. These are followed by vomiting of dark or yellowish matter, which may be luminous; pain and tenderness over the abdomen, increased by pressure; and occasionally diarrhœa. The pulse is feeble, and the skin is bathed in cold sweat.

In some cases the symptoms are chiefly due to the effects of the poison on the nervous system, and include cramps, convulsions, delirium, and prostration; in others, hæmorrhage from different parts of the body forms the most prominent condition.

On the third or fourth day after apparent recovery, the patient may be attacked with violent vomiting and intense thirst, jaundice and enlarged liver, rapid feeble pulse, coldness of the skin, scanty urine, and prostration. In almost every case coma supervenes, and death occurs on the fifth or sixth day after swallowing the poison.

This late stage of phosphorus-poisoning resembles acute yellow atrophy; but the following distinctions are usually drawn: In the former, jaundice is generally preceded by acute gastritis; the liver becomes enlarged in most cases, but the lobules remain distinct; and leucin and tyrosin are seldom found in the urine. In the latter, gastritis rarely precedes jaundice; the liver is much reduced in size and its lobules are obliterated; and the urine contains leucin and tyrosin.

Treatment.—If possible, empty the stomach with an emetic of sulphate of copper or the pump, and wash it out with 1 per cent. solution of permanganate of potash.

Give peroxide of hydrogen or ozonized turpentine; of the latter, forty minims every quarter of an hour for an hour, and half a drachm three times a day for three or four days. Opium may be necessary. Let the patient take mucilaginous drinks, but not oils as they dissolve the poison. Clear out the bowels.

On **post-mortem** examination the smell and luminous vapour of the poison may be given off. The stomach and bowels are found inflamed and sometimes ulcerated, and there may be effusions of blood. If the early symptoms have been survived, there may be fatty degeneration of the liver, which is usually enlarged, and of the muscles, kidneys, and other organs. In these cases free phosphorus may not be found, as it may have been converted into phosphoric acid.

Tests.—Distilled in the dark, its luminous vapour appears even when present in very small quantity, if the luminosity is not prevented by certain substances, such as turpentine and ammonia (Mitscherlich's test).

The vapour blackens filter-paper moistened with a solution of nitrate of silver, but not if it is moistened with a solution of acetate of lead (Scherer's test).

The vapour forms with nascent hydrogen (produced as in Marsh's test for the detection of arsenic) phosphoretted hydrogen, which burns with a green flame (Blondlot's test).

PTOMAINES

are alkaloids produced in the decomposition of animal matter. When they occur during life they are often referred to as 'leucomaines.'

The common origin of all alkaloids, animal and vegetable, is albumin, and they are extracted by the same

process. It may therefore be suggested that the alkaloid obtained from a dead body is a ptomaine. The only actively poisonous ptomaines isolated from dead bodies are *neurine* and *mydaleine*, but these are found only in very small quantities, and not until the fifth or sixth day after death. In animals they produce cardiac and respiratory depression, salivation, and profuse diarrhœa.

It appears that no ptomaine corresponds with any of the vegetable alkaloids in chemical reaction and physiological effects. But there is no absolute test for distinguishing them, as a class, from vegetable alkaloids.

SNAKE POISONS

are probably albumoses. They are very virulent, and appear to cause death by paralyzing the motor centres.

The common viper, or adder, is the only venomous snake in England. It produces local swelling and redness or lividity, with pain. The **symptoms** following this are : gastro-intestinal irritation, difficult breathing, quick feeble pulse, reduction of temperature, general prostration and paralysis, sometimes convulsions, and death in a very short time.

The cobra poison is the most virulent of all the snake poisons. The local appearances are similar to those in adder poisoning, but they are more intense and extensive. The **symptoms** may appear in a few minutes after the bite, but may be delayed for three or four hours. At first they may resemble intoxication, but afterwards they become similar to those of glosso-pharyngeal paralysis, with prostration. The paralysis may become general, and death is sometimes preceded by convulsions.

In the **treatment**, cleanse the wound by sucking it and

washing it with permanganate of potash lotion, care being taken, after sucking, to thoroughly rinse out the mouth. Give strychnine hypodermically until the effects of the poison are overcome. Ammonia, internally, has been recommended.

STRYCHNINE

is the chief active principle in *nux vomica*. Although it is seldom used by the homicide, on account of its very bitter taste, there have been some noted cases of murder by it. Usually, it is fatal by accident. Many vermin-killers contain it as their chief ingredient.

Half a grain of the sulphate and thirty grains of *nux vomica* have been fatal doses. As strychnine is an accumulative poison, the last dose may be a very small one. Death has occurred in ten minutes, and is due to asphyxia and exhaustion resulting from tetanic convulsions produced by increased excitability of the motor centres of the cord.

The **symptoms** may appear in a few minutes. There is a hot bitter taste with intense thirst, feeling of suffocation, and quick feeble pulse. Tetanic convulsions come on early; nearly all the muscles are affected at the same time; and the head is bent back, the body arched, and the limbs stretched out so that the patient rests on his head and heels—*opisthotonos*. This state, which is accompanied by asphyxia, due to fixation of the chest, and by intense pain, lasts a minute or longer, is followed by complete intermission, and is renewed in a few minutes, a slight sound or touch being sufficient to bring it on. In fatal cases the fits increase in frequency, and the patient becomes exhausted. The mind is usually clear up to death.

Strychnine-poisoning and tetanus may resemble each other, but they are easily distinguished.

In *strychnine poisoning*, there is the history that something has been administered, and quickly followed by the fits, which do not begin at the jaw or neck, but affect the body generally, and have complete intermissions. In fatal cases, death usually occurs in less than two or three hours.

In *tetanus*, there is, as a rule, the history of an injury a few days before the gradual outset of the contractions, which begin in the muscles of the jaw and neck, and extend to the trunk and limbs. Although the contractions may diminish, there are no periods of complete intermission. Death, which is the usual sequel, does not take place till after several hours or days.

Treatment.—If possible, empty the stomach with the pump or an emetic. Give bromide of potassium dissolved in water; and hypodermic injections of hydrate of chloral, five grains every ten minutes, while convulsions continue. To relieve the fits give inhalation of chloroform. Physostigmine has been recommended.

Post-mortem, the body temperature may be found to have increased, the brain and cord may be congested, the blood may be dark and fluid, and the general appearances may be those of asphyxia. Rigor mortis comes on early, is very intense, and tends to remain a long time. Strychnine is a very stable alkaloid, and has been found in the viscera in advanced putrefaction. It is found chiefly in the liver and central nervous system as well as in the alimentary canal; but it may not be detected if death is later than a few hours after a dose, on account of its rapid elimination, chiefly by the urine, and the wide distribution throughout the body of the little that remains.

Tests.—This alkaloid has a powerful and persistent

bitter taste. A few drops of strychnine solution injected under the skin of a frog produce tetanic convulsions.

Manganese dioxide or bichromate of potash added to a solution of strychnine in a little cold strong sulphuric acid produces a blue colour which changes through purple to red and ultimately to yellow.

SULPHURETTED HYDROGEN

acts as a poison when inhaled, or swallowed, or applied to the unbroken skin as an aqueous solution. As it is much used in the laboratory, and is the chief toxic agent in sewer gas, accidental poisoning by it may readily occur. Death is due to asphyxia and paralysis of the central nervous system. An atmosphere containing 0.05 per cent. of the gas produces serious toxic effects.

The **symptoms**, which are most marked after inhaling the gas, are: giddiness, throbbing and feeling of constriction at the temples; laboured respiration increasing to asphyxia; feeble pulse; and collapse, which may be preceded by delirium or convulsions. Vomiting and pain in the stomach may occur if the poison has been swallowed.

Treatment.—Remove the patient to pure air and perform artificial respiration. Give dilute chlorine gas with care, or oxygen by inhalation, and stimulants. If the poison has been swallowed, empty the stomach and give a very weak solution of chlorinated lime or soda.

Post-mortem examination reveals the general appearances of asphyxia; the blood is liquid and brownish-black, and putrefaction is likely to be rapid.

Test.—It has the odour of rotten eggs, and blackens filter-paper moistened with a solution of a salt of lead.

SULPHURIC ACID

Most cases of poisoning by this acid are accidental, chiefly through its extensive use as 'vitriol,' and the careless manner in which it is kept in dwelling-houses. The rare cases of homicide are in children, but adults have been seriously injured by the acid being thrown on them. It is occasionally used by suicides, who are mostly women. It acts as a corrosive and gastric irritant, and, like other corrosive liquids, the violence and extent of its action depend not only on the quantity, but also on the degree of concentration.

Death has occurred in three-quarters of an hour, and is due to shock, or, in some cases, to asphyxia caused by congestion of the glottis. One teaspoonful has been a fatal dose.

The **symptoms** begin at once with severe burning pain from the mouth to the stomach, accompanied by vomiting of a dark acid substance which is mixed with blood and stains and corrodes whatever it comes in contact with. Diarrhœa is a rare occurrence. There is great thirst, with pain on swallowing, and the lips and mouth are corroded except in some cases, in children, in which the acid has been poured directly into the throat. Respiration becomes difficult, the pulse quick and feeble, the skin cold and clammy, and complete collapse supervenes.

If the patient survives the acute symptoms, he may die weeks or months after, from constriction of the œsophagus or pylorus, or destruction of the gastric glands, as in poisoning by caustic potash.

In the **treatment**, avoid the pump and emetics. Give magnesia, or carbonate of magnesium, sodium, or potas-

sium, in water. If none of these are at hand, give lime or plaster off the wall, or whiting, or soap, taking care to have the remedy freely mixed with water. Olive-oil and demulcents should follow. Ammonia and, if necessary, opium, should be given hypodermically. Tracheotomy may be necessary.

The **post-mortem** appearances are corrosion of the skin wherever the poison has fallen on it, and of the mucous membrane of the mouth, throat, gullet, stomach and duodenum. The stomach is injected with dark blood, presents black patches, and is perforated more frequently in poisoning by this acid than by any other corrosive. The blood is thick and syrupy. When the acid has been poured directly into the pharynx, and not swallowed, its effects may be found only in the pharynx and larynx—the lips, mouth, œsophagus, and stomach being free from its action.

The stains on the skin and dark cloth are brown, those on cloth remaining moist for some time.

Tests.—Acidity is shown by litmus-paper.

Nitrate of barium added to a solution of the acid throws down a white precipitate insoluble in strong hydrochloric acid.

Free sulphuric acid may not be detected, as it may have been neutralized.

TARTAR EMETIC,

or tartarated antimony, is most frequently poisonous by accident. It has been taken instead of tartaric acid and cream of tartar. By the homicide it is usually given in small doses frequently repeated, in order to simulate gastro-enteritis, and thus escapes detection.

Death is caused by gastro-intestinal irritation and

general depression. It has occurred in seven hours, and has followed a dose of two grains.

The acute **symptoms** are similar to those in acute poisoning by arsenious acid. In chronic cases they resemble those in gastro-enteritis; there is persistent vomiting and diarrhoea with abdominal pain, depression becomes extreme, and the patient dies from exhaustion.

Treatment.—Assist vomiting with mustard-and-water, or, if necessary, use the tube, with caution. Give tannin or strong tea or tincture of cinchona, and stimulants. Opium may be required to allay pain and vomiting, and ice may be useful for this purpose. Give demulcent drinks, and apply heat.

The principal **post-mortem** appearances are inflammation and sometimes ulceration of the stomach and bowels, particularly the cæcum. The lungs may be congested. In chronic poisoning there may be fatty degeneration of the liver and kidneys, and ulceration of the cæcum and other parts of the alimentary canal.

Tests.—Deposits can be obtained by Marsh's and Reinsch's processes. They are distinguished from similar deposits of arsenic by methods described under 'Arsenious Acid.'

TOBACCO

poisoning is usually accidental, rarely intentional. It is caused by the action of the liquid and volatile alkaloid nicotine, and can occur not only when tobacco is smoked—especially with 'the first pipe'—or swallowed, or snuffed, or used as an enema, but also when it is applied to the unbroken skin.

Death is due to gastro-intestinal irritation and general paralysis of the nervous system, and has occurred as early

as five minutes. A dose of thirty grains has been fatal. Probably one or two drops of nicotine would kill.

The **symptoms** begin with a feeling of heat in the mouth and throat, with nausea, which is soon followed by vomiting and perhaps violent purging. The patient becomes faint and prostrate, the pulse feeble and intermittent, respiration laboured, and the skin cold and pallid. Prostration, which is both nervous and muscular, increases, and death may be preceded by convulsions.

Treatment.—Empty the stomach, if necessary, with the pump or an emetic. Give tannin or tincture of iodine by the mouth; and stimulants and strychnine hypodermically. Keep the patient in the recumbent position and apply heat, or perform artificial respiration if required.

The chief **post-mortem** condition is congestion of the alimentary canal, brain, lungs, and liver. If tobacco-leaves have been swallowed, fragments of them may be found and their odour recognised.

Test.—The alkaloids nicotine and conine resemble each other, both being liquid and volatile; but they are distinguished by the test given under ‘Conium.’

ZINC

The sulphate and the chloride are the salts of zinc that produce acute poisoning.

The sulphate has been accidentally taken instead of Epsom salts, which it closely resembles. It acts principally as a gastro-intestinal irritant—violent vomiting, pain in the abdomen, and frequently purging, being the chief **symptoms**. It is rarely fatal, and recovery has followed an ounce. The fatal dose is not known.

The chloride acts as a violent corrosive as well as an irritant, and causes death through profound general pros-

tration. Six grains have been a fatal dose, and death may occur in four hours. The **symptoms** are those of severe gastro-intestinal irritation and corrosion: vomiting, diarrhœa, and burning pain from the mouth to the stomach, together with those of profound prostration—feeble pulse, irregular breathing, and cold clammy skin—which may end in coma.

Treatment.—For the sulphate, the tube may be necessary if spontaneous vomiting is not sufficient. For the chloride, give carbonate of potash or soda, followed by tannic acid or tea, and white of egg and milk. For either, heat, stimulants, or opium may be necessary, according to the symptoms.

On **post-mortem** examination, the alimentary canal is congested in poisoning with the sulphate; but with the chloride it is inflamed and corroded, the mucous membrane being in parts detached.

Chronic poisoning is apt to occur among smelters of zinc, or from drinking water or milk kept in zinc vessels, the chief symptoms being gastro-intestinal irritation and sometimes peripheral neuritis.

Tests.—With a zinc solution: hydrate of potassium gives a white, gelatinous precipitate soluble in excess of the reagent; ferrocyanide of potassium gives a pale gelatinous precipitate; and, if the solution is neutral or alkaline, ammonium sulphide throws down a white precipitate.

TABLE OF THE DOSES OF REMEDIES REFERRED TO IN THE TREATMENT OF POISONS

Those marked with an asterisk are non-official.

Æther	...	...	...	Repeated	...	...	10 to 30 m.
"	...	...	...	At once	...	...	40 to 60 m.
Ammoniæ Spiritus Aromaticus	...	...	...	Repeated	...	...	20 to 40 m.
"	"	"	...	At once (well diluted)	...	...	60 to 90 m.
Ammonii Carbonas	...	...	...				3 to 10 gr.
Amyl Nitris	...	...	...	By the mouth (dissolved in rectified spirit 1 to 12)	...	...	$\frac{1}{2}$ to 1 m.
"	"	...	...	By inhalation (from a crushed capsule)	...	...	2 to 5 m.
Apomorphinæ Hydrochloricum	...	...	...				$\frac{1}{10}$ to $\frac{1}{4}$ gr.
"	"	"	...	Hypodermically	...	...	$\frac{1}{20}$ to $\frac{1}{10}$ gr.
Atropinæ Sulphas	...	...	...	Hypodermically	...	...	$\frac{1}{200}$ to $\frac{1}{100}$ gr.
"	"	Liquor	...				$\frac{1}{2}$ to 1 m.
Calci Carbonas	...	...	...				10 to 60 gr.
Calcis, Liquor	...	...	...				1 to 4 oz.
"	"	Saccharatus	...				20 to 60 m.
Chloral Hydras	...	...	...				5 to 20 gr.
Cinchonæ, Tinctura	...	...	...				$\frac{1}{2}$ to 1 fl. dr.
Citricum Acidum	...	...	...				5 to 20 gr.
Cupri Sulphas	...	...	...	(As an emetic)	...	...	5 to 10 gr.
Digitalis, Tinctura	...	...	...				5 to 15 m.
*Digitalium	...	...	...	Hypodermically	...	...	$\frac{1}{100}$ to $\frac{1}{80}$ gr.
*Eserinæ Salicylas	...	...	...	Hypodermically	...	...	$\frac{1}{100}$ to $\frac{1}{20}$ gr.
*Ferrum Dialysatum	...	...	...				1 oz.

*Ferri Peroxidum (Moist)	Repeated (in arsenic poison- ing)	$\frac{1}{2}$ oz.
Hydrogenii, Liquor Peroxidi		$\frac{1}{2}$ to 2 dr.
Iodi, Tinctura	(Diluted)... ..	2 to 5 m.
Magnesia	Repeated	5 to 30 gr.
„	At once	30 to 60 gr.
Magnesiæ Carbonas	Repeated	5 to 30 gr.
„ „	At once	30 to 60 gr.
„ Sulphas	Repeated	30 to 120 gr.
„ „	At once	$\frac{1}{4}$ to $\frac{1}{2}$ oz.
Morphinæ Acetas		$\frac{1}{8}$ to $\frac{1}{2}$ gr.
„ Acetatis, Liquor		10 to 60 m.
„ Hydrochloridum		$\frac{1}{8}$ to $\frac{1}{2}$ gr.
„ Hydrochloridi, Liquor		10 to 60 m.
„ Hypodermica, Injectio	Hypodermically	2 to 5 m.
Opii, Tinctura	Repeated	5 to 15 m.
„ „	At once	20 to 30 m.
Opium		$\frac{1}{2}$ to 2 gr.
Physostigmatis, Extractum		$\frac{1}{4}$ to 1 gr.
Physostigminæ Sulphas		$\frac{1}{60}$ to $\frac{1}{20}$ gr.
Pilocarpinæ Nitras		$\frac{1}{20}$ to $\frac{1}{2}$ gr.
„ „	Hypodermically	$\frac{1}{10}$ to $\frac{1}{3}$ gr.
Potassii Bromidum		5 to 30 gr.
„ Carbonas		5 to 20 gr.
„ Permanganas		1 to 3 gr.
„ Permanganatis, Liquor	(In distilled water)	2 to 4 dr.
Ricini Oleum		1 to 8 fl. dr.
Sodæ Chlorinatæ, Liquor...		10 to 20 m.
Sodii Bicarbonas		5 to 30 gr.
„ Carbonas		5 to 30 gr.
„ Sulphas	Repeated	30 to 120 gr.
„ „	At once	$\frac{1}{4}$ to $\frac{1}{2}$ oz.
Strychninæ Hydrochloridi, Liquor		2 to 8 m.
*Strychninæ Nitras	Hypodermically	$\frac{1}{150}$ to $\frac{1}{30}$ gr.
*Strychninæ Sulphas	Hypodermically	$\frac{1}{150}$ to $\frac{1}{30}$ gr.
Tannicum Acidum		2 to 5 gr.
Tartaricum Acidum		5 to 10 gr.
Zinci Sulphas	(As an emetic)	10 to 30 gr.

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